UCRL-AR-116710

Maintenance Implementation Plan for Nonreactor Nuclear Facilities

Lawrence Livermore
National Laboratory

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Submitted to
Department of Energy

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Preface

Lawrence Livermore National Laboratory (LLNL) has prepared this Maintenance Implementation Plan for Nonreactor Nuclear Facilities to comply with Department of Energy Order 4330.4B and University of California Contract 48. This Maintenance Implementation Plan reinforces LLNL's commitment to develop a coordinated maintenance program to optimize critical systems and equipment performance.

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1. Executive Summary

Summary

Lawrence Livermore National Laboratory (LLNL) has prepared this Maintenance Implementation Plan (MIP) for Nonreactor Nuclear Facilities to comply with Department of Energy (DOE) Order 4330.4B, Maintenance Management Program, and University of California Contract 48. These documents require that LLNL provide a description of its nuclear facilities and the status of compliance. This MIP provides a self assessment of our status and a plan for implementing applicable requirements.

The MIP reinforces the Laboratory's commitment to develop a coordinated maintenance program to optimize critical systems and equipment performance. LLNL will accomplish this by implementing incremental enhancements to the Maintenance Management Program. We have formulated an Implementation Schedule (see Figure 5-1) to achieve compliance through the application of the graded approach to all maintenance and maintenance-related activities. We do not request any deviations from DOE Order 4330.4B, Maintenance Management Program, at this time.

Maintenance Implementation Plan Objectives

The objective of this plan is to achieve continuous improvement through a program based on:

- Clear, concise, and valid requirements in procedures, work instructions, and other documents
- Active management involvement

The MIP establishes corrective actions based on self-assessments and feedback that will be used to adjust, modify, or improve the maintenance program and update the MIP.

Maintenance Implementation Plan Responsibility

Working with DOE, we have developed an maintenance program that will enhance the existing maintenance program and satisfy DOE Order 4330.4B, Maintenance Management Program, Chapter II requirements within the existing limits of cost control, site real-time maintenance needs, and other DOE-required activities.

The division of responsibility and Laboratory policy for implementing maintenance is established in the Director's Maintenance Policy Statement. Responsibility for maintenance activities at LLNL is shared between the programs that own the facilities and several institutional organizations, including Maintenance and Operations Department and Hazards Control.

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1. Executive Summary, Continued

Maintenance Implementation Plan Responsibility, Continued

In general, institutional organizations are responsible for the maintenance of common real property and installed equipment (RP&IE, i.e., institutional property) while the program is responsible for the maintenance of personal property and programmatic equipment (PP&PE, i.e., programmatic equipment). Maintenance of programmatic equipment is further divided between the Facility Manager and the Program Manager.

Capital Assets Management Organization

To meet this challenge, the Laboratory has established a Capital Assets Management Organization (CAMO) to oversee coordination and implementation of the MIP. The Laboratory's approach to implementing the MIP is to create a program that will serve as the platform for the development, standardization, coordination, and incremental implementation of MIP elements. The approach will incorporate successful existing programs, operational precepts, and processes at LLNL. It will provide the basis for unilateral application of maintenance management elements to all maintenance organizations. The program will also provide latitude to the nuclear facilities for exceptions, deviations, or alternatives necessary to meet programmatic mission requirements.

In This Document

This MIP includes the following topics:

2. **Introduction**—Provides background for the MIP including the:
   - Basis for the MIP
   - Location of LLNL
   - Laboratory mission
   - Facility description, including it's history and scheduled life
3. **Implementation of the Graded Approach**—Describes how LLNL applies the graded approach to maintenance based on an assessment of risk.
4. **Maintenance Implementation Plan**—Describes LLNL's overall maintenance plan for PP&PE and RP&IE (details about RP&IE are presented in Appendix A).
5. **Implementation Schedule**—Presents LLNL's schedule for implementing this maintenance plan.
6. **Abbreviations and Acronyms**

Appendix A—Presents Plant Engineering's self assessment and planned improvements for RP&IE.

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1. Executive Summary, Continued

In This Document, Continued

Appendix B—Presents the self assessments for nuclear facilities and planned improvements for PP&PE. These include:

B.1—Building 231

B.2—Building 233

B.3—Building 251

B.4—Building 255E

B.5—Building 331

B.6—Building 332

B.7—Separator Demonstration Facilities Complex (Buildings 490, 491, and 493)

B.8—Hazardous Waste Management Facilities (Buildings 233, 513, 514, 612, and 693)

B.9—Building 334

Note that several facilities at LLNL are downloading and no longer house nuclear material and, therefore, do not need Maintenance Implementation Plans. Downloading facilities include:

- Building 239
- Building 343
- Building 812E

2. Introduction

Basis for the Maintenance Implementation Plan

This Maintenance Implementation Plan (MIP) establishes a course of action to ensure availability and operability of Laboratory structures, systems, and components important to safe and reliable nonreactor nuclear facility operations. This MIP actively employs a graded approach that optimizes the use of existing resources and provides strict adherence to environmental, safety, and health requirements. It was developed using information gained from:

- Previous audits and evaluations
- Area audits
- Recent maintenance organization self-assessments
- Performance-based evaluations of plant maintenance activities
- A comprehensive review of:
  - Department of Energy (DOE) Order 4330.4B, Maintenance Management Program
  - Requirements of University of California Contract 48
  - Proposed Rule Making for nuclear facilities under 10CFR830.340, "Maintenance Management"

Location of LLNL

LLNL consists of two sites:

- The main Livermore site, Site 200, which has eight designated nuclear facilities
- A high-explosive test site, Site 300, located in the Corral Hollow district

Figure 2-1 shows the location of the two sites relative to metropolitan San Francisco.

Laboratory Mission

LLNL is a multiprogram research laboratory operated by the University of California for the DOE. The Laboratory functions as a national resource of scientific and technical expertise for the nation's defense programs and other programs of national interest. Major programs conducted at LLNL include weapons research, development, and testing; inertial confinement fusion; verification and control technology; nuclear safeguards and security; laser isotope separation; defense waste and environmental restoration; magnetic fusion energy; biomedical and environmental research; basic energy sciences and CO_2 research; applied mathematical sciences; commercial nuclear waste; fossil energy; and atmospheric and geophysical science. LLNL also performs research on a variety of projects for other DOE contractors and government agencies.

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2. Introduction, Continued

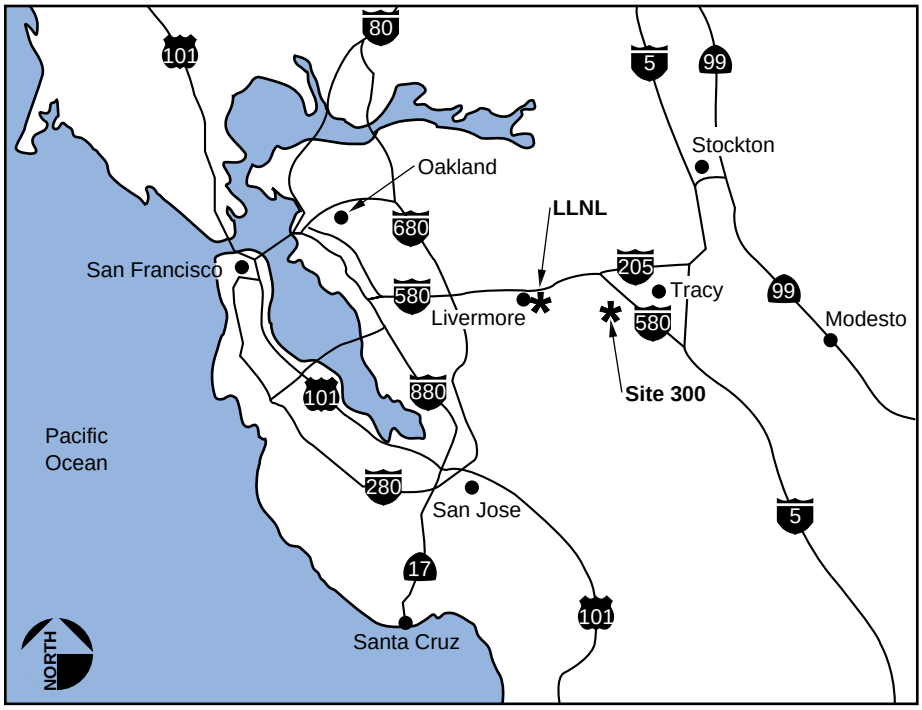

Figure 2-1. Location of LLNL Sites.

Facility Description

LLNL is located on 3.3 km^2 about 80 km southeast of San Francisco. As of January 1994, 9,673 individuals occupied 509,879 gross m^2 of facilities at the Livermore site. This population figure includes approximately 7,938 University of California employees, 1,524 non-Laboratory personnel, and 138 DOE employees. Approximately 56% of the total Laboratory office population at Livermore are housed in adequate facilities, 33% are housed in facilities that need rehabilitation, and 11% are housed in facilities that need to be replaced. Temporary facilities (mostly trailers, modular buildings, and World War II buildings) constitute 24% of the occupied building space.

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2. Introduction, Continued

Nuclear Facilities Description

Figure 2-2 shows the location of the seven nuclear facilities at LLNL Site 200. They are:

- Building 231, Development and Assembly, and Building 233, Storage Vault
- Building 251, Heavy Element Facility
- Building 331, Tritium Facility
- Building 332, Plutonium Facility
- Buildings 490S, 491, and 493, Separator Demonstration Facilities Complex
- Buildings 233 CSU, 513, 513A, 514, 514A, 612, 612A, 614, 625, and Trailers 6197, 6197B, and 6198, Hazardous Waste Facilities
- Building 334, Hardened Engineering Test Building

For a more detailed description of these nuclear facilities, see Appendix B.

LLNL Facility History and Scheduled Life

The main LLNL site began as a Naval Air Station in 1947 and became Lawrence Livermore Radiation Laboratory in 1952. Since that time, the site has continued to develop, resulting in a mix of facilities and utilities that includes World War II buildings and new, modern laboratories still under construction.

The infrastructure is as mixed as the buildings. For example, we are upgrading the electrical distribution system as part of a multiyear line item construction project. However, major portions of the site are still served by high-voltage distribution systems built by the Navy. We are also renovating the aging and technically obsolete mechanical utilities. The master plans for these systems address the undersizing that has resulted from continuing Laboratory expansion. A variety of funding sources are being explored to enhance the reliability of these systems.

2. Introduction, Continued

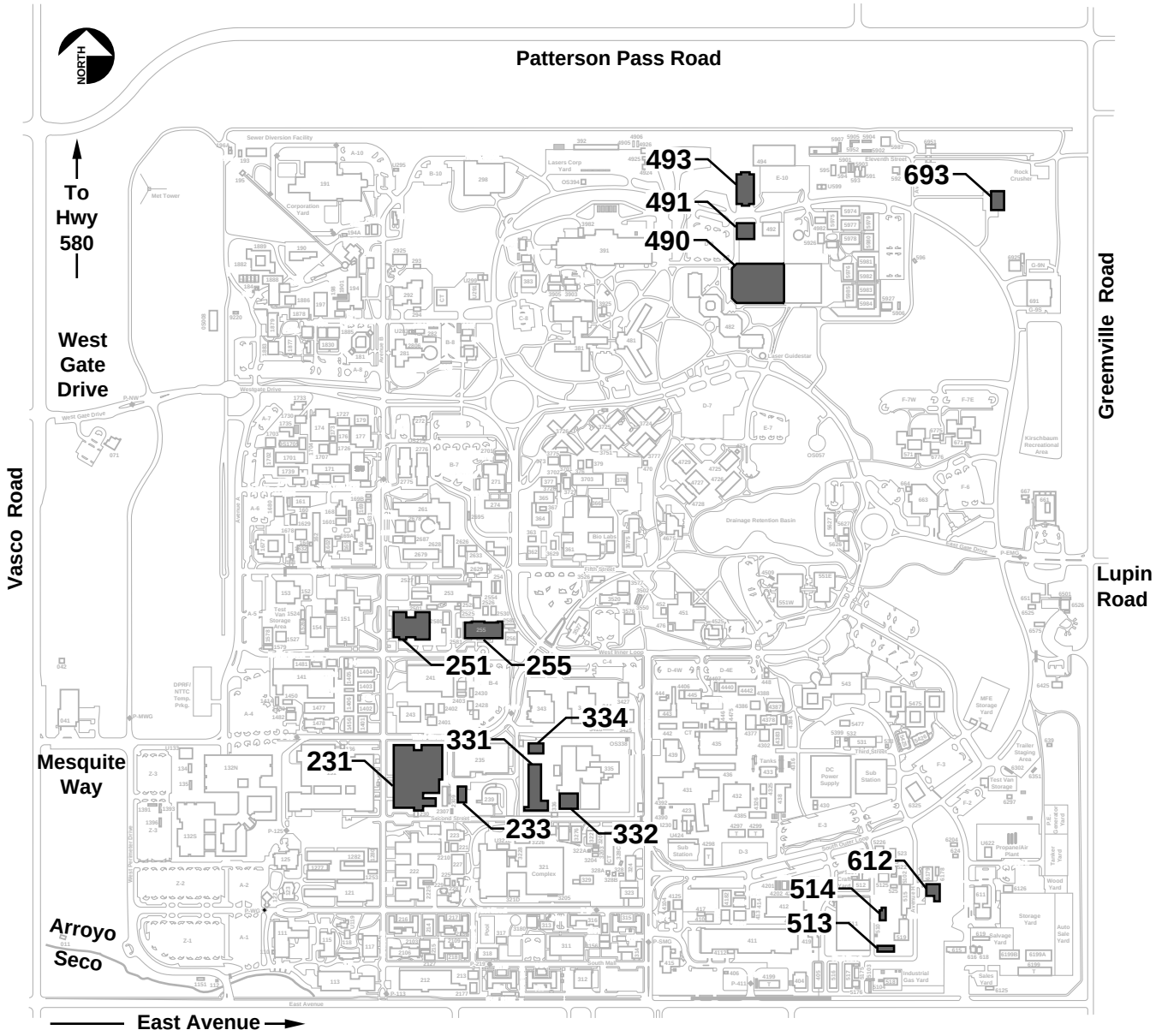

Figure 2-2. Location of LLNL Nuclear Facilities.

3. Implementation of the Graded Approach

Introduction

The primary function of the maintenance organization is to ensure the safe and reliable operation of facilities by establishing a strong maintenance philosophy and culture designed to achieve excellence in maintenance. The successful application of standards, values, and convictions requires a team effort and a dedicated commitment to a maintenance plan that encourages continuous quality improvement.

Graded Approach for Maintenance

Lawrence Livermore National Laboratory (LLNL) applies a graded approach to maintenance of its various facilities and programs. Graded approach refers to the selective and judicious assignment of resources to the maintenance of structures, systems, and components based on their level of risk. This approach is flexible and is used for facilities and programs in which the criteria are selected for use based on the identified risk and the program need.

This graded approach is subjective and depends on the professionalism of the responsible people involved. The basic intent and methodology of the grading process is to have a knowledgeable person thoughtfully consider the risk, value, and appropriate action in establishing controls on maintenance activities. These considerations often involve relative, and not absolute, characteristics that may also change over time. The process may be formal or informal, depending on the item, risk, and the process involved.

LLNL's graded approach is based on Department of Energy (DOE) Order 4330.4B, Maintenance Management Program, and emphasizes health, safety, and the environment. It assumes that the depth of detail required and the magnitude of resources expended for a particular maintenance management element must be commensurate with the element's importance to:

- Safe and reliable operations
- Environmental compliance
- Safeguards and security
- Programmatic mission
- Facility preservation
- Facility-specific requirements

Continued on next page

3. Implementation, Continued

Risk

The graded approach assumes a concept of risk that includes both assumed and unassumed risks. Workers directly involved with hazards inherent to their jobs have assumed certain risks; however, even the assumed risk should be mitigated in accordance with the As Low As Reasonably Achievable (ALARA) concept. This may involve physical barriers, administrative controls, training, and personal protection. Our approach emphasizes those risks associated with nuclear, chemical, biological, and explosives research hazards that are not assumed.

Many sources of information may be used to assess risk, such as safety and environmental analyses, Facility Safety Procedures (FSPs), Operational Safety Procedures (OSPs), accident analysis, risk prioritization, prior or operational experience, etc. Except for special cases where quantitative analysis is required or available, however, a certain level of subjectiveness is involved in grading structures, systems, and components and in prioritizing maintenance resources. Ultimately, the determination of actions or priorities is made from the informed judgment of a knowledgeable person who is accountable for such decisions.

Factors Influencing the Successful Use of the Graded Approach

Successful use a graded approach a depends on the following factors:

- Development of a complete list of structures, systems, and components to be maintained. This is often referred to as a Master Equipment List.
- Accurate identification and assessment of the hazards associated with each structure and system.
- Documentation of the risk-rating process to facilitate future revision as hazardous operations change.
- Assessment of discernible levels of maintenance commensurate with the number of risk classifications assigned.

Method of Applying the Graded Approach

The graded approach will assist Facility Managers in assigning structures, systems, and components to a reasonable risk category when a Safety Analysis Report or other formal risk assessment is not needed. The process described below may be augmented or superseded by a more comprehensive risk-analysis method at the discretion of the Facility Manager. In the interim, this approach should allow structures, systems, and components to be categorized by personnel knowledge about the individual facility even if they are not formally trained in risk assessment. This approach places the emphasis on identified potential hazards and does not attempt to quantify risks except in gross terms.

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3. Implementation, Continued

Method of Applying the Graded Approach, Continued

Structures, systems, and components will be categorized by assigning a risk-rating number representing the potential of a failure affecting each of the following areas:

1. Public
2. Laboratory Workers
3. Environment
4. Security and Safeguards
5. Mission/Economic

Consequence scales will be used in the risk areas, and the highest area ratings will determine the hazard category. Structures, systems, and components will be evaluated assuming the worst case, credible failure. The likelihood of the failure will be considered in determining credibility of a failure. The following scales will be used to rate the anticipated results of the worst case credible failure for the five identified areas.

Risk Ratings
Public Safety
1. Death or serious injury or illness of a member of the public
2. Minor illness, injury, irritation, or annoyance
3. No public impact
4. No public impact
Laboratory Workers
2. Death or serious (disabling) injury or illness of a Laboratory worker
3. Minor injury or illness to a Laboratory worker
4. No illness or injury to an employee

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3. Implementation, Continued

Risk Ratings, Continued

Environment

1. Severe damage to the environment beyond the boundaries of the Laboratory or requiring major cleanup
2. Damage to the environment within the Laboratory boundaries, requiring limited cleanup
3. Damage to the environment limited to the immediate area around the facility and requiring minimal cleanup
4. No damage to the environment

Safeguards and Security

2. May allow loss or theft of Category 1 of special nuclear material (SNM) or national security information
3. May allow loss or theft of Category 2 or 3 quantities of SNM or classified information
4. No loss of SNM or secure data

Mission/Economic Impact

2. Total loss of the use of a facility or major process, or severe mission or economic impact
3. Damage to a facility or process, or serious mission or economic impact
4. Minor damage that results in inconvenience, or no damage to facility or process

Risk Categories

The highest of the risk ratings assigned to the various areas will determine the risk category for a given structure, system, or component. The category corresponds to the area ratings as follows:

- Category 1—Highest Area Rating = 1
- Category 2—Highest Area Rating = 2
- Category 3—Highest Area Rating = 3
- Category 4—Highest Area Rating = 4

The judgment of the cognizant Facility Manager or Responsible Investigator may be exercised to designate maintenance levels higher than derived by this process, if reasons are documented.

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3. Implementation, Continued

Assignment of Risk Ratings

The graded approach will be applied at the system level to first categorize the systems within a facility. The first priority will be identification of those systems in Categories 1 or 2. The next priority will be identification of those systems in Category 3. Ultimately, a Master Equipment List will be developed by a facility that will identify the components that comprise the Category 1, 2, and 3 systems. Individual components may be categorized using the same grading scheme and considering the components' impact on the performance of the system. Those systems that are identified as Category 4 will not be included in the Master Equipment List.

Assignment of Accepted Industrial Risks

There are many potentially hazardous systems and components in laboratories that are common to industry and are regarded as acceptable industrial risks. These systems and components are normally governed by consensus codes that establish inspection or maintenance schedules. These systems and components will be assigned to Categories 2 or 3 depending on their potential impact. Examples of these systems include but are not limited to cranes, elevators, boilers, pressure vessels, pressure relief valves, fire protection systems, fire detection systems, fire suppression systems, emergency lights, emergency generators, electrical distribution, electrical controls, guardrails, traffic signals, and backflow preventers.

Levels of Maintenance for Risk Categories

The graded approach has identified: (1) a gradation scheme for categorizing structures, systems, and components, and (2) a discernible level of maintenance for each risk category. One of the factors affecting the success of using the graded approach is identifying a discernible level of maintenance for each risk category. The level of maintenance required for each of the four risk categories is described below.

Category 1 Level of Maintenance

The Category 1 level of maintenance assumes a rigorous and formalized maintenance program that emphasizes reliability and minimizes the probability of failure. The full range of maintenance activities will be used to ensure that the structures, systems, and components operate within design requirements and to demonstrate that all reasonable precautions have been taken. This will include, as applicable, preventive maintenance inspections, predictive maintenance tests, training and qualification requirements defined for maintenance personnel, configuration management, detailed procedures for maintenance and repair, post-maintenance testing, thorough maintenance history, analysis of failures, and trending of performance.

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3. Implementation, Continued

Category 2 Level of Maintenance

The Category 2 level of maintenance assumes a formalized program that employs all reasonable maintenance activities to control risks. The full range of maintenance activities may be used to ensure the proper operation of structures, systems, and components, but the emphasis will be on those activities that can reasonably be expected to significantly enhance safety or reliability. The responsible maintenance manager will determine which maintenance activities are most effective for assuring safety or reliability.

Category 3 Level of Maintenance

The Category 3 level of maintenance assumes good business and maintenance practice, economic benefits, and prudence. The maintenance activities applied to these structures, systems, and components will be determined based largely on programmatic importance and economic factors. The application of preventive maintenance inspections or tests will be based on the expectation of reducing maintenance costs or improving reliability for the sake of productivity.

Category 4 Level of Maintenance

The Category 4 level of maintenance is limited to only fixing items when they are broken. The maintenance activities applied to these structures, systems, and components will be limited to repair and recurring maintenance such as lubrication or cleaning.

Identification of Structures, Systems, and Components in the Maintenance Program

The graded approach will be applied to all buildings classified as either high, medium, low, or excluded in the *Facility Hazard Classification Report* prepared by Hazards Control. Facility Managers of facilities that are excluded are encouraged to identify systems that are critical to security or their programmatic mission. This information will assist Plant Engineering and other maintenance support organizations in the planning and scheduling of utility outages and in responding to unplanned outages and other emergencies.

The graded approach need *not* be applied to equipment such as office machines, vehicles, personal computers, and other automated data processing equipment because these items are excluded by University of California (UC) Contract 48, Appendix E maintenance program requirements.

Systematic Analysis of Structures, Systems, and Components in the Maintenance Program

The steps in performing the graded approach evaluation are:

1. Determine the individual structures, systems, and components (SSC) that directly support the facility.
2. Compile all readily available information relating to impact of failure.
3. If available information is not sufficient, postulate the consequence of *potential* system failure.

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3. Implementation, Continued

Systematic Analysis of Structures, Systems, and Components in the Maintenance Program, Continued

4. Grade each structure, system, and major component using the methodology provided in this procedure or locally developed and documented methodology.
5. Transmit the completed evaluations to the Capital Assets Management Organization (CAMO).

This process is illustrated graphically below:

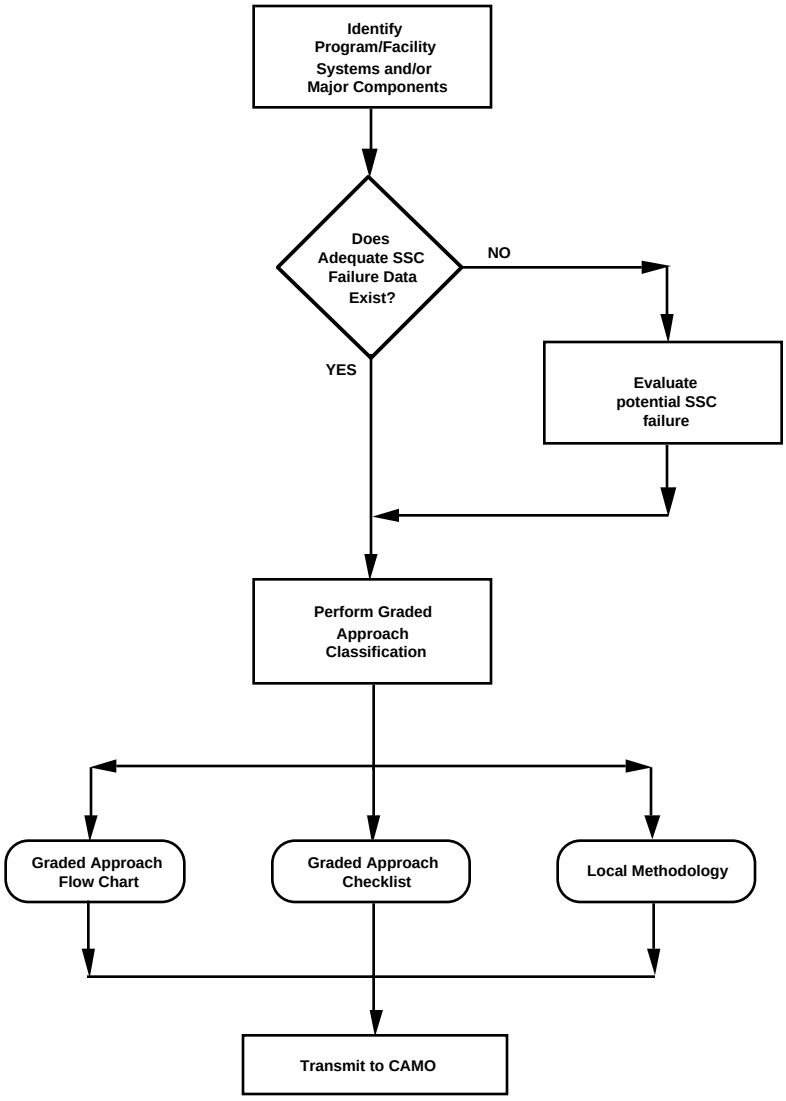

Figure 3-1. Systematic Analysis of Structures, Systems, and Components.

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3. Implementation, Continued

Maintenance Assignments and Authority

The following individuals and organizations are responsible for making maintenance assignments. Their responsibilities are described in the following sections:

- Facility Managers
- Program Managers, Lead Experimenters, and Responsible Individuals
- Maintenance Engineering and Production Control Organization (MEPCO)
- Support Organizations
- Capital Assets Management Organization (CAMO)
- Responsible Associate Director or designated individual

Facility Managers

Facility Managers shall:

- Ensure the application of the graded approach is completed for the real property and installed equipment (RP&IE) and personal property and programmatic equipment (PP&PE) that are part of the facility.
- Perform and document the graded-approach evaluation for all structures, systems, and components that are the maintenance responsibility of the Facility Manager.
- Review and approve the graded-approach applications developed by the programs within their facility for PP&PE with environment, safety, and health (ES&H) implications that is owned, operated, and maintained by specific programs operating within a facility.
- Review and approve the graded-approach applications developed by MEPCO for the RP&IE within their facility.
- Transmit all completed graded-approach evaluations for PP&PE and RP&IE in their facility to CAMO.
- Carry out their ES&H maintenance responsibilities in accordance with the framework provided in the FSPs, OSPs (see Chapter 2 of the *Health and Safety Manual)*, this Maintenance Implementation Plan (MIP), and internal documents.
- Ensure that their maintenance program is kept up-to-date.

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3. Implementation, Continued

Program Managers, Lead Experimenters, and Responsible Individuals

Program Managers, Lead Experimenters, and Responsible Individuals shall:

- Perform and document a graded-approach evaluation to determine the system component grade on all PP&PE for which they have maintenance responsibility.
- Submit graded-approach applications for systems and major components with ES&H implications to the Facility Manager for review and approval.
- Submit graded-approach applications for systems and major components with no ES&H implications to the Facility Manager for transmittal to CAMO. The Facility Manager is not required to review graded-approach applications for systems and major components with no ES&H implications.

Maintenance Engineering and Production Control Organization

MEPCO shall *:*

- Perform and document the graded-approach evaluation for RP&IE as requested by the cognizant Facility Manager.
- Justify and develop the budget and level of maintenance needed to support the programmatic mission, as indicated by the classification of Category 1, 2, or 3 level of maintenance for all systems, structures, and components for which MEPCO has the primary maintenance responsibility.

Support Organizations

Support organizations shall review and concur with the system, structure, and component classifications on PP&PE for which they have maintenance responsibility and establish a maintenance program to support the level of maintenance indicated.

Capital Assets Management Organization

CAMO shall:

- Coordinate the application of the graded approach for maintenance in accordance with this document.
- Assure that system lists and risk classification information are reviewed by the appropriate support organization(s) as applicable.
- Provide an interface between Facility Managers, support organizations, UC, and DOE.

Responsible Associate Director or Designated Individual

The responsible Associate Director or designated individual shall have final approval authority on all system graded-approach classifications and the impact on maintenance resources, including RP&IE.

4. Maintenance Implementation Plan

In This Section

This section of the Lawrence Livermore National Laboratory (LLNL) Maintenance Implementation Plan (MIP) for nuclear facilities and support organizations describes how the 18 elements of Chapter II of Department of Energy (DOE) Order 4330.4B, Maintenance Management Program, will be applied to real property and installed equipment (RP&IE) and to personal property and programmatic equipment (PP&PE). The differences in the approach to the maintenance of RP&IE and the approach to PP&PE are based on the differences in how the types of property are maintained.

This section includes the following subsections:

4.1 Real Property and Installed Equipment—Provides a description and objectives of how DOE Order 4330.4B, Maintenance Management Program, Chapter II, will be applied to RP&IE. A detailed self assessment and planned improvements of LLNL's RP&IE in response to DOE Order 4330.4B, Maintenance Management Program, is presented in Appendix A.

4.2 Personal Property and Programmatic Equipment—Provides a detailed description of how DOE Order 4330.4B, Maintenance Management Program, Chapter II, is applied to PP&PE. Self assessments for the specific facilities are presented in Appendix B.

Maintenance Responsibility

RP&IE is maintained by the central maintenance organization using craft-workers. In this case, maintenance is provided by one organization for a number of other organizations and the full requirements of the order are appropriate to ensure that maintenance is properly controlled, coordinated, and performed.

PP&PE is normally maintained by the operating organization that owns the property. In this case, one organization has both operating and maintenance responsibilities and, where maintenance and operations are integrated, some of the requirements of the order are not essential.

We will use the DOE-approved graded approach to apply the full requirements of Chapter II of DOE Order 4330.4B, Maintenance Management Program, to the maintenance of RP&IE.

4.1 Real Property and Installed Equipment

Introduction

LLNL's overall RP&IE maintenance program for nonreactor nuclear facilities, referred to as the Critical Facilities Maintenance Program (CFMP), was developed using information gained from:

- A comprehensive review of DOE Order 4330.4B, Maintenance Management Program, particularly the elements described in Chapter II of DOE Order 4330.4B, Maintenance Management Program
- Previous audits and evaluations
- Area audits
- Recent maintenance organization self assessments
- Performance-based evaluations of plant maintenance activities
- Proposed Rule Making for nuclear facilities under 10CFR830.340, Maintenance Management

The CFMP applies only to Category 1 and 2 Level of Maintenance as defined in University of California (UC) Contract 48, Appendix E, and establishes a course of action to ensure availability and operability of Laboratory structures, systems, and components important to safe and reliable facility operations. The CFMP actively employs a graded approach that optimizes the use of existing resources and provides for strict adherence to environmental, safety, and health (ES&H) requirements.

Objective

The objective of this plan is to achieve continuous improvement through a program based on:

- Clear, concise, and valid requirements in procedures, work instructions, and other documents
- Craftworker skills, developed through performance-based training and qualification
- Coordinated and standardized work-control processes
- Active management involvement

See Appendix A for LLNL's self assessment and planned improvements for maintenance of RP&IE.

4.1 Real Property and Installed Equipment, Continued

Critical Facilities Maintenance Program

The CFMP establishes corrective actions, self-assessments, and feedback that will be used to adjust, modify, or improve the maintenance program and update the CFMP.

The CFMP reinforces the Laboratory's commitment to develop a coordinated maintenance program for RP&IE to optimize critical systems and equipment performance. We will accomplish this by implementing incremental enhancements to the Maintenance Management Program that will result in compliance with DOE Order 4330.4B, Maintenance Management Program, Chapter II. We developed an implementation schedule (see Figure 5-1) to achieve compliance through application of the graded approach to all maintenance and maintenance-related activities. No deviations from DOE Order 4330.4B, Maintenance Management Program, Chapter II for RP&IE are requested at this time.

4.2 Personal Property and Programmatic Equipment

Responsibility for Maintenance of Personal Property and Programmatic Equipment

Maintenance of personal property and programmatic equipment (PP&PE) is assigned to the operating organizations whose primary mission is research or research support. PP&PE does not include office furniture, office equipment, and personal computers. The operating organization may perform the required maintenance using any of the following:

- Its scientists and technicians
- An outside contractor
- The central maintenance organization

Most organizations use operating organization personnel. Maintenance performed by the central maintenance organization will be in accordance with Appendix A. Building shells will be maintained in accordance with Appendix A.

Major Elements of the Maintenance Management Program

Because the maintenance of PP&PE is an integral part of operations, the following five elements will be the focus of the maintenance management program for PP&PE. These five elements form the core of an efficient maintenance program. The performance objective for each element is included.

1. **Identify/Grade—**Each organization should identify the equipment that is part of its maintenance responsibility. The graded approach should be applied to categorize structures, systems, or components according to consequence of failure.
2. **Maintenance Procedures**—Maintenance requirements should be documented in procedures to provide appropriate work direction and to ensure that maintenance is performed safely and efficiently.
3. **Training and Qualification**—Training and qualification programs should assure that maintenance is done by personnel with the required knowledge, skills, and certifications commensurate with the consequence of the equipment to be maintained.
4. **Scheduling**—Corrective and preventive maintenance should be scheduled and coordinated so that maintenance activities are performed efficiently and within prescribed time limits.
5. **Equipment Repair History**—An equipment repair history should be established and maintained to provide historical information for analysis of equipment performance.

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4.2 Personal Property and Programmatic Equipment, Continued

Element-by-Element Review of Chapter II

An element-by-element review of Chapter II of DOE Order 4330.4B, Maintenance Management Program, follows. The specific element is quoted first and is followed by a discussion of our plan to address that issue. We will use a graded approach and, where applicable, the discussion below includes a statement as to how some elements will be applied to high-importance systems.

Note: No. 1 is the general introduction and requires no specific application.

Graded Approach and Risk Categories

The graded approach identifies four categories of risk, with Category 1 representing the highest level and Category 4 representing the lowest level. This document identifies specific actions for high-importance systems and different actions for low-importance systems:

- Category 1 and 2 systems are high-importance systems
- Category 3 systems are medium-importance systems
- Category 4 systems are low-importance systems

2. Maintenance Organization and Administration

The organization and administration of the maintenance function should ensure that a high level of performance is achieved through effective implementation and control of maintenance activities.

LLNL will establish a central maintenance oversight responsibility for the purpose of providing specific guidance to and oversight of the operating organizations in the maintenance of their equipment. We will develop guidance for implementing and controlling maintenance to ensure a consistent approach to maintenance across the operating organizations at each site. The guidance will emphasize ES&H and the documentation requirements of maintenance activities. We will document the maintenance policy and communicate the maintenance requirements to the operating organizations through the established systems of Laboratory directives.

3. Training and Qualification of Maintenance Personnel

A Maintenance Training and Qualification Program is essential to ensure that the skills and knowledge needed by maintenance personnel to effectively perform maintenance activities are developed and maintained.

LLNL will document its training programs. For high-importance PP&PE, we will document required maintenance and repair skills and develop training and qualification programs. For low-importance PP&PE, we will use basic technician skills.

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4.2 Personal Property and Programmatic Equipment, Continued

4. Maintenance Facilities, Equipment, and Tools	*Maintenance facilities, equipment, and tools should efficiently support facility maintenance and maintenance training.* Maintenance and operations are integrated, performed, or directed by the same organizational personnel; therefore, the need for maintenance facilities and equipment separate from those required for operation is not a significant issue. We will identify the requirement for special tools or support equipment in the maintenance procedures for high-importance PP&PE.
5. Types of Maintenance	*A proper balance of corrective and preventive maintenance should be employed to provide a high degree of confidence that facility equipment degradation is identified and corrected, that equipment life is optimized, and that the maintenance program is cost-effective.* LLNL will develop equipment lists for those systems considered important for ES&H protection and production. Maintenance requirements and scheduling frequencies will be determined. We will document preventive and predictive maintenance requirements at the organizational level for high-importance PP&PE. For low-importance PP&PE, we will base preventive and predictive maintenance on programmatic importance and economic considerations.
6. Maintenance Procedures	*Maintenance procedures and other work-related documents (e.g., drawings and instructions) should be prepared and used to provide appropriate work direction and to ensure that maintenance is performed safely and efficiently.* The facilities will develop maintenance procedures with emphasis on ES&H. For high-importance PP&PE, we will develop equipment-specific detailed procedures. Maintenance procedures will specify the applicability and use of other work-related documents. The maintenance requirements may be documented in other procedures such as operating or calibration procedures as appropriate.
7. Planning, Scheduling, and Coordination of Maintenance	*An effective system for planning, scheduling, and coordinating maintenance activities should be implemented in order to: ensure that maintenance is accomplished in a timely manner; improve maintenance efficiency; reduce radiation exposure (ALARA); and increase equipment availability.* LLNL will develop scheduling capability for the preventive maintenance activities required for high-importance PP&PE. Control of outages will be inherent in the process because the operating personnel will be performing or directing the maintenance.

Continued on next page

4.2 Personal Property and Programmatic Equipment, Continued

7. Planning, Scheduling, and Coordination of Maintenance, Continued	Formal planning of maintenance for PP&PE will not be required because crafts and craft sequencing are not normal concerns. Coordination with other organizations will be addressed in the maintenance procedures referenced in Element 6.
8. Control of Maintenance Activities	*Management-directed and -delegated involvement in control of maintenance activities should ensure that maintenance practices are effective in maintaining safe and reliable facility operation.* Our primary focus on maintenance control for PP&PE will be to ensure that systems important to safe operation are functioning properly during operations. Once a problem is detected in a system that is important to safe operation, the safety system will be repaired before operations continue, or a documented management decision will be made to operate without the full capability of the safety system. A work request system is not be required for maintaining PP&PE because it adds little value to maintenance that is an integral part of operations.
9. Post-Maintenance Testing	*Post-maintenance testing should be performed to verify that components will fulfill their design function when returned to service after maintenance.* LLNL will include post-maintenance testing in its maintenance procedures. Post-maintenance testing will be required and documented for high-importance PP&PE.
10. Procurement of Parts, Materials, and Services	*Parts, materials, and services required for maintenance activities should be available when needed.* LLNL will document its procedures for procurement of maintenance materials and services (see Element 11 below).
11. Material Receipt, Inspection, Handling, Storage, Retrieval, and Issuance	*All phases of receiving, inspecting, handling, storing, retrieving, and issuing equipment, parts, and materials for maintenance should be covered by effectively implemented policies and procedures consistent with Quality Assurance requirements from the time an item is received until it is installed in the facility.* For high-importance PP&PE, we will review the need for on-hand spare parts at the organizational level and establish spare parts stock as required to support the operation. We will establish controls to ensure that the critical spare parts for high-importance PP&PE are properly identified, stored, and retrievable (see Element 10 above).

Continued on next page

4.2 Personal Property and Programmatic Equipment, Continued

12. Control and Calibration of Measuring and Test Equipment	*The program for control and calibration of measuring and test equipment (M&TE) should be consistent with Quality Assurance requirements and ensure the accurate performance of facility instrumentation and equipment for testing, calibration, and repairs.* LLNL will establish and document calibration programs for their measuring and test equipment. The maintenance procedures referenced in Element 6 above will identify the need for calibrated M&TE when maintaining high-importance PP&PE.
13. Maintenance Tools and Equipment Control	*Methods should be established to provide for storage, issuance, and maintenance of an adequate and readily available supply of tools and equipment and also for the development of special tools and equipment needed in the maintenance program.* LLNL will document the tools and consumable supplies normally needed for maintenance of high-importance PP&PE in maintenance procedures (see Element 6 above).
14. Facility Condition Inspection	*Management should conduct periodic inspections of equipment and facilities to assure excellent facility condition and housekeeping.* LLNL will establish inspection requirements for high-importance PP&PE. General housekeeping and cleanliness inspections of operating areas will be addressed in LLNL guidance.
15. Management Involvement	*To ensure the safety of DOE nuclear facility operations, DOE and contractor corporate and facility managers should be sufficiently involved with facility operations to be technically informed and personally familiar with conditions at the operating facility.* Line manager involvement is implicit in the integration of operations and maintenance under the purview of the operating organizations. Organizations will apply performance indicators based on the performance and productivity of their PP&PE as indicators of the effectiveness of their maintenance efforts.

Continued on next page

4.2 Personal Property and Programmatic Equipment, Continued

16. Maintenance History	*A maintenance history and trending program should be maintained to document data, provide historical information for maintenance planning, and support maintenance and performance trending of facility systems and components.* We will develop equipment repair history and vendor information systems at the organizational level to record the repair history, including post maintenance testing for high-importance PP&PE.
17. Analysis of Maintenance Problems	*System analysis should be used to determine and correct root causes of unplanned occurrences related to maintenance.* LLNL will document its failure analysis programs and use maintenance history systems (referenced in Element 16) to identify multiple or frequent failures. Failures of high-importance PP&PE will require determination of cause and followup analysis, while failures of low-importance PP&PE will be analyzed at the discretion of the operating personnel.
18. Modification Work	*Facility modification work, including temporary modifications, should be accomplished under the same basic administrative controls as those applied to facility maintenance activities so that there is no increases in risk to facility equipment, environment, or personnel because of the modification work.* We will develop and document our configuration management (CM) programs. The full requirements of the CM program will be applied to all work that involves temporary repairs or permanent system modifications to high-importance systems, equipment, and components.
19. Additional Maintenance Management Requirements	*A program should be in place to prevent equipment and building damage due to cold weather at any nuclear facility that may be at risk.* The vast majority of items requiring seasonal maintenance activities and freeze protection are RP&IE. However, we will review PP&PE that is located outside or otherwise exposed to the elements and devise seasonal procedures if there is a significant potential for damage caused by extreme weather conditions.

5. Implementation Schedule

Introduction

The Maintenance Implementation Plan (MIP) reinforces the Laboratory's commitment to develop a coordinated maintenance program to optimize critical systems and equipment performance. Lawrence Livermore National Laboratory (LLNL) will accomplish this by implementing incremental enhancements to the Maintenance Management Program.

Milestone Schedule

Figure 5-1 presents a list of activities and scheduled completion dates required to complete the implementation of the maintenance requirements, using the graded approach, of Department of Energy (DOE) Order 4330.4B, Maintenance Management Program, as negotiated in Appendix E of University of California (UC) Contract 48. The schedule summarizes the activities that are common to the implementation at each laboratory. Implementation details will vary because of differences in organization, management, and structure and programs of the laboratories.

The schedule shows completion dates for the various tasks; however, a subsequent task may begin before a previous task is completed. The completion dates and tasks will be reviewed annually and modified as agreed by all affected parties.

Definition of Milestones

An effective maintenance program must include a process to accommodate changes in facilities, facility usage, etc. Therefore, completion of a milestone will be defined as a established process that has been completed for the existing facilities. The completion of each activity depicted on the schedule will be certified by UC.

Graded Approach and Risk Categories

The graded approach identifies four categories of risk, with Category 1 representing the highest level and Category 4 representing the lowest level. Categories 1 and 2 both include safety systems; however, the Category 1 systems have potential for off-site consequences while Category 2 systems are restricted to on-site consequences. This document identifies specific actions for high-importance systems and different actions for low-importance systems:

- Category 1 and 2 systems are high-importance systems
- Category 3 systems are medium-importance systems
- Category 4 systems are low-importance systems

Continued on next page

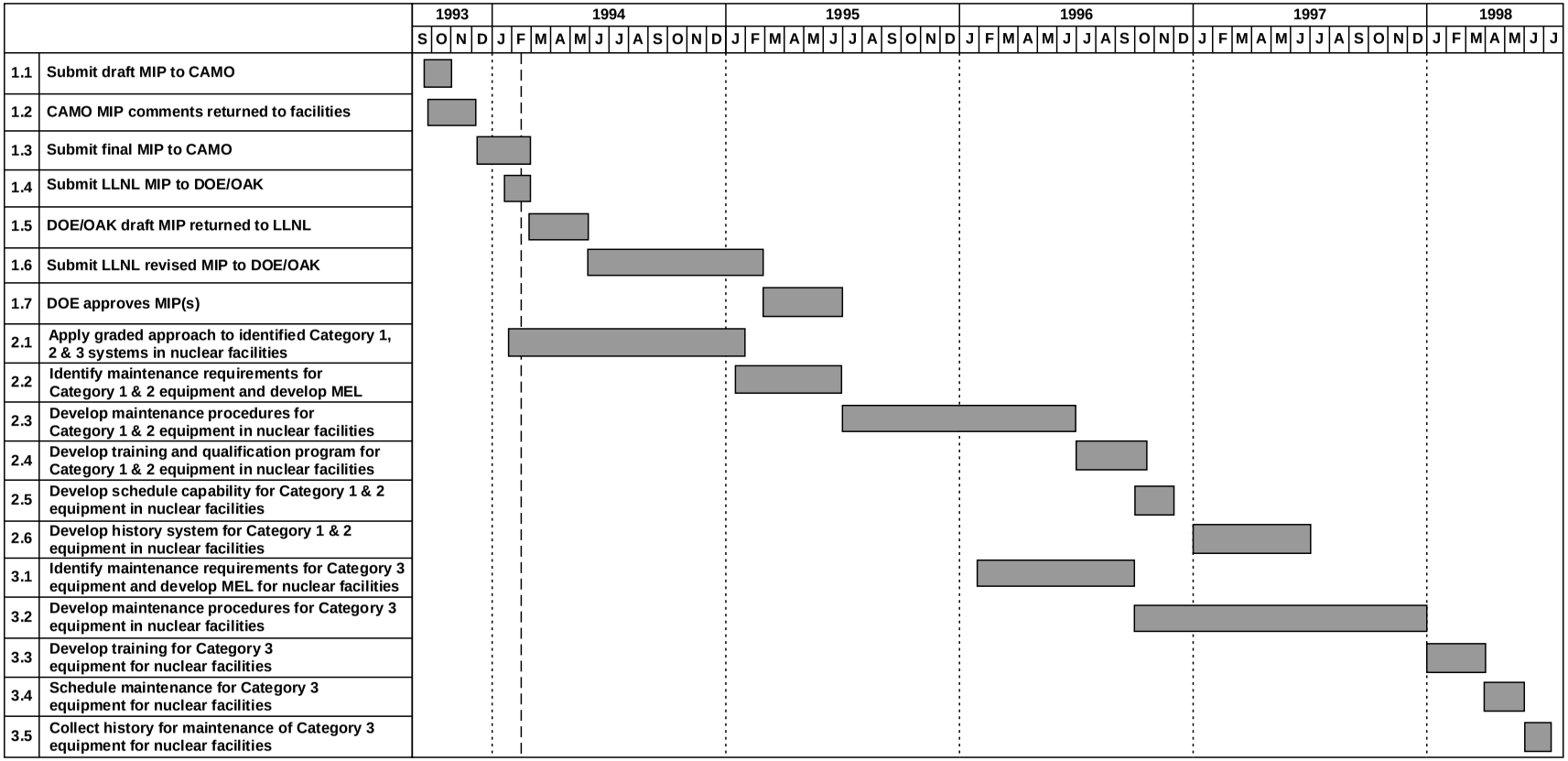
5. Implementation Schedule

Graded Approach and Risk Categories, Continued

Graded Approach Category	Level of Maintenance	Master Equipment List
1	Rigorous and formalized maintenance program to minimize failure	Systems and equipment will be included in the Master Equipment List
2	Formalized program that employs all reasonable maintenance activities to control risks	Systems and equipment will be included in the Master Equipment List
3	Good business and maintenance practices, economic benefits, and prudence	Systems and equipment will be included in the Master Equipment List
4	Repair as needed	Need not be included in Master Equipment List

It is important to remember that each system and major component evaluation will result in a level of maintenance, with commensurate resources, dedicated to that system. Therefore, this evaluation will ultimately determine where maintenance resources should be directed.

Figure 5-1. Implementation Schedule.



6. Abbreviations and Acronyms

ALARA	As Low As Reasonably Achievable
BSS	building safety systems
CAMO	Capital Assets Management Organization
CAS	Condition Assessment Survey
CBSR	Contractor Business Management System Review
CFMP	Critical Facilities Maintenance Program
CM	configuration management
CQI	Continuous Quality Improvement
DOE	Department of Energy
ES&H	environment, safety, and health
FSP	Facility Safety Procedure
HEPA	high-efficiency particulate air (filters)
HMW	Hazardous Waste Management (Division)
HVAC	heating, ventilating, and air-conditioning
LLNL	Lawrence Livermore National Laboratory
MEL	Master Equipment List
MEPCO	Maintenance Engineering and Production Control Organization
MIP	Maintenance Implementation Plan
M/O	Maintenance and Operations
M&TE	measuring and test equipment
NELA	Nuclear Explosive-Like Assemblies
OJT	on-the-job training

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6. Abbreviations and Acronyms, Continued

OSP	Operations Safety Procedure
PDM	predictive maintenance
PM	preventive maintenance
PMT	post-maintenance testing
PP&PE	personal property and programmatic equipment
R&D	research and development
RMA	Radioactive Materials Area
RP&IE	real property and installed equipment
RWP	Radiological Work Permit
S&D	Supply and Distribution
SAR	Safety Analysis Report
SDF	Separator Demonstration Facilities
SME	Subject Matter Expert
SNM	special nuclear material
SSC	structures, systems, and components
SSR	Support Services Request
TIR	Tritium Inventory Removal
TSR	technical safety requirement
U-AVLIS	Uranium Atomic Vapor Laser Isotope Separation
UC	University of California
UPS	uninterruptible power system

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Appendix A
Real Property and Installed Equipment

Introduction

Plant Engineering is responsible for maintaining real property and installed equipment (RP&IE) and ensuring its safe and reliable operation by establishing a strong maintenance philosophy and culture designed to achieve excellence in maintenance. The successful application of standards, values, and convictions requires a team effort and a dedicated commitment to a maintenance plan that encourages continuous quality improvement.

In This Section

This section presents Lawrence Livermore National Laboratory's (LLNL's) overall RP&IE maintenance program for nonreactor nuclear facilities. It describes the 18 elements of Chapter II of Department of Energy (DOE) Order 4330.4B, Maintenance Management Program.

An element-by-element review of Chapter II of DOE Order 4330.4B, Maintenance Management Program, follows. The specific element is quoted first and is followed by a discussion of:

- Our objectives
- The current status of our compliance
- Planned improvements

For more complex issues, there may be several subsections discussions for each element. No deviations from DOE Order 4330.4B, Maintenance Management Program, Chapter II for RP&IE are requested at this time.

Note: No. 1 is the general introduction and requires no specific application. Please see Section 4.1 for more information about the basis for the Maintenance Implementation Plan (MIP), program objectives, and the Critical Facilities Maintenance Program (CFMP).

2. Maintenance Organization and Administration

The organization and administration of the maintenance function should ensure that a high level of performance is achieved through effective implementation and control of maintenance activities.

This is accomplished by establishing policies, goals, objectives, and the accountability needed in facility maintenance. Our response to this element is discussed under the following subsections:

- Maintenance program policies
- Long-term maintenance strategy

Continued on next page

Real Property and Installed Equipment, Continued

2. Maintenance Organization and Administration, Continued

- Staffing resources
- Goals and objectives
- Accountability

Maintenance Program Policies

Objective

The objectives of the RP&IE facilities Maintenance Management Program policies are to:

- Place primary emphasis on public and worker safety
- Provide required oversight coordination and direction for all RP&IE facility maintenance activities
- Establish and communicate clear and concise RP&IE maintenance policies to all affected personnel
- Designate the Facility Managers as the single point of contact responsible for the overall quality of the maintenance program, including RP&IE, within their respective facilities
- Develop and direct a cost-effective and efficient RP&IE Maintenance Management Program
- Minimize RP&IE occurrences as defined in DOE Order 5000.3B, Occurrence Reporting and Processing of Operations Information
- Ensure the RP&IE maintenance program effectively supports the LLNL mission
- Promulgate and implement RP&IE maintenance policies through instructions and guidance provided in procedures, manuals, and other pertinent documents

Current Status

Areas of responsibility and authority for maintenance activities are not clearly defined or documented in some instances. As a result, individual organizations have assumed responsibility for certain maintenance areas, which has generated inconsistent and vaguely defined responsibilities for the remaining functional maintenance areas. The Capital Assets Management Organization (CAMO) was established in May 1992 to provide oversight and assist the Laboratory in effective implementation of maintenance related programs. The CAMO chairperson serves as the single point of contact for RP&IE and PP&PE Maintenance Management Program development and initiatives for the Laboratory.

Continued on next page

Real Property and Installed Equipment, Continued

Maintenance Program Policies, Continued

Current Status, Continued

The existing CFMP, which has been implemented for nonreactor nuclear facilities' RP&IE, actively supports the LLNL mission and programmatic operations of the designated nuclear supported facilities.

Planned Improvements

We will develop and refine RP&IE maintenance policies and procedures that will delineate the maintenance responsibilities and appropriate interfaces for real and personal property. We will develop and implement procedures and practices reflecting the maintenance policy for the individual facilities.

Long-Term Maintenance Strategy

Objective

Our objective is to develop and implement planned improvements and initiatives that will promote and support a proactive approach to RP&IE maintenance. We will place the emphasis on planned and scheduled maintenance activities rather than on reactive responses to maintenance needs. We will expand the current RP&IE maintenance program using an integrated and graded approach that will:

- Promote effective working relationships and better communication among all organizational units that support maintenance functions
- Establish performance indicators relating to maintenance support effectiveness
- Solidify and implement an effective facility inspection assessment
- Improve use of facility and systems inspection results
- Expand the identification, development, and use of written procedures
- Document work appropriately
- Use work and equipment analysis data to improve maintenance operations
- Assess, identify, and include applicable organizational equipment in the long-term maintenance strategy

Improved long-range maintenance planning that embraces these objectives will result in more effective use of resources to accomplish needed repairs to facilities and systems.

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Real Property and Installed Equipment, Continued

Long-Term Maintenance Strategy, Continued

Current Status

Under the concepts of the graded approach, the CFMP for nonreactor nuclear facilities requires a higher level of control and documentation than the overall LLNL institutional maintenance program for real property. In support of this strategy, the CFMP is steadily transitioning into a proactive maintenance operation.

Also, issues such as interface formalities and agreements are being evaluated for clarification, enhancement, and expansion. The planning of RP&IE long-range maintenance requirements needs to be effectively coordinated and applied throughout the Laboratory. Several independent methods are used to satisfy program needs but are not currently integrated into the overall Laboratory maintenance strategy.

Planned Improvements

CAMO has been formed to develop consistent Laboratory-wide definitions and policies for the development and implementation of Maintenance Management Program elements. Current CFMP initiatives will be enhanced and expanded to provide direction for improved maintenance. This effort will result in an effective and coordinated Maintenance Management Program that will apply Laboratory maintenance assets in an efficient and cost-effective manner. University of California (UC) Contract 48, Appendix F has established several performance indicators to measure the implementation of this strategy.

Staffing Resources

Objective

Our objective is to ensure that highly qualified personnel are available to support the maintenance-related needs of facilities. We will provide adequate maintenance program staffing, time, and other resources necessary to fully support both the facilities' maintenance requirements and the training and qualification program designed for the facilities.

Current Status

In practice, the screening of maintenance personnel for technical competence meets the intent of DOE Order 4330.4B, Maintenance Management Program, but lacks formality and documentation of standards. A formal Training and Qualification Program is being developed.

Continued on next page

Real Property and Installed Equipment, Continued

Staffing Resources, Continued

Planned Improvements

Full implementation of DOE Order 4330.4B, Maintenance Management Program, to meet the needs of RP&IE will require additional personnel to meet both training and maintenance requirements. Basic and continuing training programs need to be developed or enhanced for predictive maintenance techniques, audit techniques, management oversight, instructor techniques, Condition Assessment Survey (CAS) inspections, and maintenance support activities.

Goals and Objectives

Objective

Our objective is to develop a series of goals and objectives to measure the progress and effectiveness of the Maintenance Management Program. The results should be applied to improving the overall program and adjusting the MIP schedules accordingly.

Current Status

Milestones for implementation of the MIP and the associated CFMP have been established in Section 5. Performance indicators to track the progress of implementation have been established under UC Contract 48, Appendix F.

Planned Improvements

We plan to implement maintenance-related goals and objectives and measure achievements through the established performance indicators.

Accountability

Objective

Both positive and negative feedback must be provided to all maintenance personnel so that they fully understand they are accountable for their performance and that they must identify areas requiring improvements on the individual, organizational, and facility levels.

Current Status

LLNL presently has several feedback mechanisms including performance appraisals, probationary periods, informal discussions, and recognition programs. These are in addition to the Continuous Quality Improvement (CQI) initiatives that are underway. Some of these programs are not formally documented or consistently implemented.

Continued on next page

Real Property and Installed Equipment, Continued

Accountability, Continued

Planned Improvements

We will continue to implement our current programs, including CQI. We will develop and document appropriate measurements and procedures.

3. Training and Qualification of Maintenance Personnel

A Maintenance Training and Qualification Program is essential to ensure that the skills and knowledge needed by maintenance personnel to effectively perform maintenance activities are developed and maintained.

Our response to this element is discussed under the following subsections:

- Responsibilities
- Maintenance training program
- Training schedules and support
- On-the-job training
- Qualification
- Training in root-cause analysis
- Training program approval, effectiveness, and feedback
- Management and supervisory training

Responsibilities

Objective

Responsibilities for all aspects of training (identification of needs, development, funding, implementation, documentation, etc.) should be clearly defined and communicated.

Current Status

The LLNL Training Program Manual defines responsibilities for establishing, maintaining, and implementing site training programs. The Plant Operations Directorate's *Training Implementation Plan* and the Plant Engineering *Organizational Training Plan* further define training program elements and responsibilities. RP&IE maintenance organizations are currently in the process of implementing training programs based on the principles outlined in the Training Program Manual.

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Real Property and Installed Equipment, Continued

Responsibilities, Continued

Planned Improvements

We will continue to implement maintenance training programs based on the findings of the self assessment.

Maintenance Training Program

Objective

Our objective is to provide structured, performance-based training where necessary to personnel engaged in RP&IE maintenance and maintenance support (e.g., planning, engineering, procurement, and warehousing) activities.

Current Status

The objective of this element is currently being met in a practical sense, however, documentation defining required skills and knowledge does not exist in all areas. Although formal job and task lists are being developed, the LLNL Training Program Manual requires an expansion of the systematic approach to training to ensure the foundation for a Laboratory-wide training program is achieved. Institutional training such as environment, safety, and health (ES&H); radiation protection; management development; and security awareness are provided to all Plant Engineering personnel on an as-required basis. These courses are well established and under continual review for identification of new needs.

Planned Improvements

We will develop job and task lists to formally identify the required skills and knowledge for each job classification or work assignment. We will develop necessary training courses using the skills and knowledge lists and a systematic approach to training.

Training Schedules and Support

Objective

Training schedules should take into account the staffing, workload, and other commitments of the shops. Supervisors should work with their employees, management, and training personnel to identify and develop training for job classifications and individual training needs. The functional areas currently support the development of Subject Matter Experts (SMEs) to assist in developing and conducting training. Budgets to provide this training are provided by both burden and overhead accounts and are reviewed annually for adequacy.

Continued on next page

Real Property and Installed Equipment, Continued

Training Schedules and Support, Continued

Current Status

The general intent of this objective has been satisfied, although a formal description and an outline addressing these issues do not presently exist. Most development and scheduling of training takes place on a case-by-case basis rather than within the scope of a comprehensive training and development plan. No formal program exists to evaluate employee skills and knowledge or to identify present and future training needs. While formal requirements for instructor qualifications are established in the Training Program Manual, they are not implemented and enforced Laboratory-wide.

Planned Improvements

We plan to develop an integrated training schedule based on the training needs analysis discussed above. We will involve maintenance managers, supervisors, training personnel, and craftworkers in training assessment, development, and scheduling. We will expand the use of SMEs as training assets, evaluate employees for required skill levels and knowledge, and formally document the results. We also plan to implement an Instructor Qualification Program.

On-The-Job Training

Objective

Our objective is to develop and maintain a formal, documented on-the-job training (OJT) program, based on job and task analysis, that will support the training and qualification of maintenance personnel.

Current Status

While the current OJT program is effective, it lacks the formality and documentation necessary for efficient and consistent implementation. OJT instructor requirements, outlined in the Training Program Manual, have not been fully implemented. Formal guidance is not provided for OJT elements such as trainee control, trainer-to-trainee ratios, and ensuring that trainees perform maintenance only on equipment for which they have been qualified. These issues are presently addressed in an informal manner.

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Real Property and Installed Equipment, Continued

On-The-Job Training, Continued

Planned Improvements

We will continue to implement Training Program Manual requirements through the graded enhancement of existing programs. We will include policies outlined in the Training Program Manual for all OJT elements including implementation of OJT instruction requirements and the development of formal guidance for OJT elements.

Qualification

Objective

Maintenance management should ensure the technical competence of employees through a formal assessment process. The employee's technical qualifications should be documented, formally approved, and accessible for review.

Current Status

Currently, safety and other related training is conducted on a continuous basis through the Maintenance and Operations (M/O) Department Safety Organization. New personnel are not assigned work in a hazardous situation without proper training by the Shop Supervisor. Formal training is documented through several databases (e.g., LROCC and TRAQ) that support the training and qualification program.

Planned Improvements

We plan to expand, implement, and formalize the technical qualification program for each employee. Additionally, specific training for special work will be formalized.

Training in Root-Cause Analysis

Objective

Our objective is to instill an effective root-cause determination attitude toward equipment failures through comprehensive root-cause analysis training.

Current Status

Currently, formal training in root-cause analysis has been taken by a small number of personnel. Guidance for events requiring root-cause analysis is provided in the Maintenance Analysis Handbook (MOP-00006).

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Real Property and Installed Equipment, Continued

Training in Root-Cause Analysis, Continued

Planned Improvements

We plan to provide additional root-cause analysis training to the maintenance engineering staff, utility engineers, and second-line supervisors.

Training Program Approval, Effectiveness, and Feedback

Objective

Our objective is to ensure training is effective and properly implemented by directly involving maintenance management personnel in approving and periodically reviewing the overall maintenance training program. The review should consider trainee feedback as a basis for course adjustments and new course development.

Current Status

Minimal formal management involvement is currently required or solicited from the training organization. Trainee feedback comes primarily from trainee end-of-course critiques rather than from follow-up evaluations based on the application of training in the work environment.

Planned Improvements

We will enhance the existing program to include maintenance management involvement in approving and evaluating the effectiveness of training activities. We will include trainee feedback and follow-up evaluations of training applicability to the work environment in determining training effectiveness.

Management and Supervisory Training

Objective

Our objective is to develop highly capable maintenance managers by augmenting technical training with management and supervisory skills training.

Current Status

The management and supervisory training program is currently being expanded. CQI management training has been provided to Plant Engineering line managers, and the M/O Department has instituted supervisory and management training for all craft supervisors.

Continued on next page

Real Property and Installed Equipment, Continued

Management and Supervisory Training, Continued

Planned Improvements

We will continue to expand and implement current initiatives to all managers and supervisory personnel, and these initiatives will be continually evaluated through our self-analysis effort.

4. Maintenance Facilities, Equipment, and Tools

Maintenance facilities, equipment, and tools should efficiently support facility maintenance and maintenance training.

Our response to this element is discussed under the following subsections:

- Facilities
- Tool and Equipment Storage
- Office Equipment

Facilities

The following facilities are discussed below:

- Shops and Satellite Work Areas
- Laydown and Staging
- Storage Facilities
- Temporary Facilities and Decontamination Facilities

Shops and Satellite Work Areas

- **Current Status**—A facility needs analysis was completed for the major RP&IE facilities; it identified needs for increased support areas, centralized tool crib, measuring and test equipment (M&TE) control area, etc. The analysis also identified outlying shops and administrative buildings that should be replaced, refurbished, or reallocated to another purposes. For example, the paint shop and the heavy equipment shop are both slated for replacement.
- **Planned Improvements**—The central tool crib, including M/O Department M&TE functions, has been established and is operational. The specific work unit is scheduled to be returned to Building 511 in mid-1995. Requests for and documentation of needed shop upgrades are included in the LLNL CFMP submission.

Continued on next page

Maintenance of Real Property and Installed Equipment, Continued

Facilities, Continued

Laydown and Staging

- **Current Status**—Internal and external laydown and staging areas are not clearly identified. Projects are underway to relocate material to provide for better use by the crafts. In addition, Plant Engineering is conducting a Space Utilization Study to determine the functional needs of the work groups as well as ways to promote the safe, efficient use of laydown and staging areas. A report on the progress of the study is periodically provided to the M/O Department so that improvements can be made while the study continues.
- **Planned Improvements**—We will provide clear, identifiable marking for all laydown and staging locations. We will also provide clear identification of equipment, tools, and supplies staged for specific upcoming jobs. An alphabetic or alpha-numeric listing with inventory update capabilities for each laydown and staging area will be developed.

Storage Facilities

- **Current Status**—Measures have been taken to reduce the level of M/O's in-house inventory to support safe and reliable operations while ensuring better space use. An automated inventory control system has been developed and installed for M/O stores that controls high/low limits and reorder points. An inventory of spare parts and other shop materials stored in the transportainers (moveable containers) has been conducted and the results entered into the inventory control system. Because of the age of the buildings that support the M/O Department, existing conditions, and the range of services provided by M/O, storage space for tools, parts, and materials is presently inadequate in most shops.
- **Planned Improvements**—We plan to develop a program to provide adequate storage space for tools, parts, and material.

Temporary Facilities and Decontamination Facilities

- **Current Status**—Work performed on a program with potential radioactive contamination hazards is controlled by the facility-specific programs. Tools and equipment are usually stored and provided by the nuclear facility requesting the work. Decontamination facilities are maintained by the facility.
- **Planned Improvements**—We will develop inventories of the tools and equipment located in each facility Radioactive Materials Area (RMA).

Continued on next page

Maintenance of Real Property and Installed Equipment, Continued

Tool and Equipment Storage

Current Status

Formerly, each maintenance shop maintained its own tools inventory; however, LLNL has developed a central tool crib and is in the process of transferring all tools to it.

Planned Improvements

We will continue to transfer tools to the central tool crib.

Office Equipment

Current Status

The office equipment available for use is currently sufficient to support the maintenance organization. Reevaluations of office equipment needs should be performed on a formally determined schedule.

Planned Improvements

We will improve efforts to ensure that an appropriate balance of office equipment is provided for the efficient and safe operation of LLNL facilities. We will also develop a program that provides for the periodic reassessment of office equipment needs.

5. Types of Maintenance

A proper balance of corrective and preventive maintenance should be employed to provide a high degree of confidence that facility equipment degradation is identified and corrected, that equipment life is optimized, and that the maintenance program is cost-effective.

A cost-effective maintenance program is a balance between preventive, predictive, and corrective maintenance. Nuclear facilities' RP&IE maintenance at LLNL is structured on these cornerstones. Our response to this element is discussed under the following subsections:

- Master Equipment List (MEL)
- Corrective maintenance
- Preventive maintenance
- Predictive maintenance
- Maintenance action and frequency selection

Continued on next page

Maintenance of Real Property and Installed Equipment, Continued

Master Equipment List

Objective

Our objective is to provide a detailed component listing that is capable of supporting fundamental programs such as maintenance history, technical baseline, component labeling, and preventive maintenance development.

Current Status

The RP&IE Master Equipment List for nuclear facilities resides in the M/O Department. All major components of the nuclear facilities are listed in various levels of detail depending on the equipment in the existing Master Equipment Lists. Special tools and equipment are not considered.

Planned Improvements

The requirements for the Master Equipment Lists are under review by the M/O Department Technical Support Group. The results of their review, expected mid-1995, will be developed into an action plan and milestones for identified and justified shortfall. A management review of this action plan and milestones will determine priority and funding availability.

Corrective Maintenance

Objective

Our objective is to reduce the frequency of corrective maintenance actions through:

1. Aggressive preventive and predictive maintenance programs
2. Effective use of root cause of failure analysis techniques

When corrective maintenance is necessary, failed equipment will be repaired expeditiously to minimize unscheduled facility downtime. We will ensure that corrective actions meet all safety and operations needs.

Continued on next page

Maintenance of Real Property and Installed Equipment, Continued

Corrective Maintenance, Continued

Current Status

Appropriate priorities are presently placed on corrective maintenance activities. Although the Whiz Tag program results in expeditious repairs, it does not have the capability to adequately collect equipment data for feedback into equipment history or analysis programs, nor does it deal with issues such as post-maintenance testing with an appropriate level of formality. The analysis-of-failure data for feedback into the preventive maintenance, training, qualification, configuration management, and other appropriate maintenance program elements requires enhancement.

Planned Improvements

We plan to modify the work control programs to provide for the appropriate level of formality, data collection, and feedback capabilities. Formalized post-maintenance testing procedures will be developed and performed as appropriate.

Preventive Maintenance

Objective

Our objective is to perform maintenance that will maximize the equipment life cycle while maintaining required availability.

Current Status

The LLNL RP&IE preventive maintenance programs are well established. They are based on a process that includes consequence classification of equipment, regular field observation of equipment condition, and computerized scheduling of maintenance activities. Tasking is developed on a combination of vendors recommendations and field experience. The program has minimal feedback ties from the corrective maintenance system. A computer-based maintenance management system is constantly being enhanced.

Planned Improvements

We plan to provide the Preventive Maintenance (PM) Program with feedback from corrective maintenance. We will compare the consequences of system or component failure to the existing PM schedule of activities and will recommend changes to PM activities on the basis of sound engineering practice. We will systematically compare equipment-failure data with preventive maintenance activities for the equipment. Corrective action information from the items above will be used to write new PM instructions or to change existing preventive maintenance frequencies and instructions.

Continued on next page

Maintenance of Real Property and Installed Equipment, Continued

Predictive Maintenance

Objective

Our objective is to increase equipment reliability by identifying failure trends and initiating planned maintenance activities at an opportune time. This will minimize lost program time and high-maintenance costs associated with breakdown failures.

Current Status

LLNL's predictive maintenance program uses the systematic observation of physical parameters, which are compared with known or predetermined limits, to assess equipment condition. This information is also used to determine how long equipment will function without failure or performance degradation. Plant Engineering has acknowledged Predictive Maintenance (PDM) as an effective tool for increasing equipment reliability while reducing maintenance costs and has established the foundation for a PDM program. PDM techniques should be expanded and consistently applied Laboratory-wide in order for LLNL to realize its maximum benefits.

Planned Improvements

We plan to expand the PDM program to include additional equipment. We will use industry standard techniques such as vibration analysis, oil analysis, motor-current signature analysis, and thermography to predict failures and to inspect new equipment for acceptance. We also plan to provide additional training in PDM data analysis.

Maintenance Action and Frequency Selection

Objective

Our objective is to improve equipment performance through enhancement of current PM tasks and frequencies by evaluating the basis for existing PM frequencies as well as available equipment maintenance and operational data.

Current Status

Although many individual PM tasks are lacking in documented source basis, the tasking has proven adequate from a field-experience perspective. Although PM tasks and frequencies were initially based primarily on vendor recommendations, they have been modified continually to meet current conditions and configurations as found though field experience and engineering judgment. We noted that few changes or modifications to the existing tasks or frequencies have been documented.

Continued on next page

Maintenance of Real Property and Installed Equipment, Continued

Maintenance Action and Frequency Selection, Continued

Planned Improvements

We plan to enhance the existing PM program by formally establishing a method to document changes and improvements to the for PM tasks and frequencies. Using maintenance analysis techniques, we will continually review the PM program for adequacy.

6. Maintenance Procedures

Maintenance procedures and other work-related documents (e.g., drawings and instructions) should be prepared and used to provide appropriate work direction and to ensure that maintenance is performed safely and efficiently.

A balanced combination of written guidance, craftworker skills, and work-site supervision is required to achieve the quality workmanship essential to safe and reliable facility operation. Our response to this element is discussed under the following subsections:

- Procedures development and writing
- Procedure verification
- Procedure validation
- Procedure approval
- Procedure use
- Procedure control, periodic review, and revision

Procedure Development and Writing

Objective

Procedures should be developed for all work that could result in a significant process transient, degraded facility reliability, or pose a personnel or equipment hazard. Procedures should also be written for individual preventive maintenance actions. For some preventive maintenance activities, actions may be documented by general, rather than individual, procedures.

Continued on next page

Real Property and Installed Equipment, Continued

Procedures Development and Writing, Continued

Current Status

A standardized format for writing RP&IE maintenance procedures is being developed, and the degree of rigor applied will be determined using the graded approach. A formal process for determining the requirements for maintenance procedure development is being established that includes participation by the Maintenance Engineering staff. There is currently no formal method that determines which maintenance activities require a general or individual procedure. Many of the current preventive and predictive maintenance procedures are written without specific values, parameters, or conditions detailed enough for observing, verifying, and documenting maintenance activities.

Planned Improvements

Our planned improvements are as follows:

- Enhance the predictive and preventive maintenance procedures to include the recording of appropriate data and provision of specific parameters and values necessary to complete the procedure.
- Develop a methodology, including the application of the graded approach, for determining what equipment requires a formal procedure based on the Master Equipment List and/or the CFMP.
- Determine the documentation detail required for procedures based on safety classification, complexity, and frequency of the maintenance task.
- Complete and implement the draft Procedure Writer's Guide.
- Involve the end users in all stages of procedure generation—including needs identification, development, verification, and validation—to ensure accuracy, comprehension, usability, and human factor design.
- Provide general procedure development orientation for procedure writers, reviewers, craftworkers, and supervisors.
- Establish a formal process for procedure development and review that includes the participation of experienced craftworkers and engineers.

Procedure Verification

Objective

Our objective is to verify and review each procedure for proper format, content, and technical accuracy. Verification of the procedure will then be conducted by one or more reviewers who were not involved in writing the procedure and who have appropriate knowledge in the activity or process addressed by the procedure.

Continued on next page

Real Property and Installed Equipment, Continued

Procedure Verification, Continued

Current Status

Formal procedures prepared by the M/O Department for use on RP&IE are reviewed and approved by a standing process including both managerial/ administrative and technical review. Each procedure has a predetermined review date.

Planned Improvements

We will continue with our current process, using the concepts of continual review wherever possible.

Procedure Validation

Objective

Our objective is to validate each procedure to ensure that it is usable and correct, and that it provides the proper guidance for performing the maintenance activity. Procedures will be validated by responsible line management prior to their use.

Current Status

Although the validation process does exist, it does not stress the practice of usability.

Planned Improvements

We plan to expand the current process to include formal field testing of the procedure before it is given final validation and approval.

Procedure Approval

Objective

As a minimum, all procedures should be approved by cognizant line management.

Current Status

Standardized approval forms have been developed for RP&IE procedures. The procedure that establishes who is responsible for review or who has final approval authority for procedures is informal in nature.

Continued on next page

Real Property and Installed Equipment, Continued

Procedure Approval, Continued

Planned Improvements

We plan to formalize the policy for the review and final approval requirements for procedures in the Procedure Writing Guide.

Procedure Use

Objective

Our objectives are as follows:

- Clearly identify all procedures and make them readily available for use.
- Clearly state procedure compliance requirements (either verbatim compliance or general intent) in the procedure so the intent can be easily understood by each craftworker.
- Establish a policy for procedure compliance and train personnel accordingly.

Current Status

A standardized procedure identification system has been developed. Compliance requirements are stated in the procedures. Step-by-step compliance has been assigned to procedures for critical facility building safety system (BSS) equipment. There is presently no document that provides guidance for procedure use, although one is being developed.

Planned Improvements

We plan to develop a administrative policy for RP&IE to establish effective procedure controls. It will include a description of procedure categories, compliance requirements, and management oversight responsibilities.

Procedure Control, Periodic Review, and Revision

Objective

Our objectives are as follows:

- Establish administrative controls for the identifying and issuing procedures. Control and document their distribution.
- Review all procedures triennially for changes affecting content (reference material revisions, permanent changes, incorporation of industry experience, etc.). Also review for philosophy, format enhancements, and human-factors considerations.

Continued on next page

Real Property and Installed Equipment, Continued

Procedure Control, Periodic Review, and Revision, Continued

Objective, Continued

- Control temporary changes (temporary alterations allowing work to be safely continued) to procedures by an administrative document. For changes that need to remain in effect beyond their original effective dates, follow the same review and approval process as required for new procedures.
- Control procedure revisions (permanent alterations that incorporate outstanding, extensive changes, and other updates) by an administrative document.
- Review and approve revisions in the same manner as new procedures.

Current Status

There are no Laboratory-wide administrative controls that provide guidance for the issue, review, change, or revision of procedures. Some functional areas, i.e., RP&IE, have established these controls and others are developing them.

Planned Improvements

We will continue to improve document and procedural handling in the M/O Department until Laboratory-wide procedures and requirements are outlined in an administrative policy that contains formal guidance for document control and distribution, triennial reviews, and temporary changes. We will include the controls already established in some functional areas. A document control system will be established to control procedure distribution and to ensure the latest revision is included in maintenance work packages. Revisions, deletions, and draft procedures will be included in the document identification system. We will provide appropriate ties to a configuration management program to ensure proposed facility and equipment changes or modifications to all Category 1 or 2 equipment. We will initiate a review of any procedures that may be affected by the change or modification.

7. Planning, Scheduling, and Coordination of Maintenance

An effective system for planning, scheduling, and coordinating maintenance activities should be implemented in order to: ensure that maintenance is accomplished in a timely manner; improve maintenance efficiency; reduce radiation exposure (ALARA); and increase equipment availability.

Maintenance activities that support the safe and reliable operation of LLNL's facilities must be effectively scheduled and coordinated. Proper planning, scheduling, and coordinating are essential to ensure that maintenance activities are accomplished in a timely manner while improving maintenance efficiency, reducing radiation exposure to as low as reasonably achievable levels (ALARA), and increasing equipment availability.

Continued on next page

Real Property and Installed Equipment, Continued

7. Planning, Scheduling, and Coordination of Maintenance, Continued

Scheduling and control must consider all aspects of maintenance including material, logistics, work preparation, and staffing support.

Our response to this element is discussed under the following subsections:

- Planning for maintenance activities
- Scheduling maintenance activities
- Coordination of maintenance activities
- Outage planning, scheduling, and coordination

Planning for Maintenance Activities

Objective

Work requests and work orders should be reviewed by planners prior to starting work. The level of review should employ a graded approach based on the scope, nature, and complexity of the maintenance activity and the safety classification of the component or system. Written administrative controls should provide guidance and instructions on all phases of planning and scheduling. The planning process should consider the following:

- Planning priorities
- Identification of required personnel resources
- Work instructions and procedures
- Required permits
- Maintenance history
- Procurement of necessary parts and material
- Location of needed parts and material
- Identification of quality control requirements
- Post-maintenance testing instructions
- Completed job documentation requirements

Continued on next page

Real Property and Installed Equipment, Continued

Planning for Maintenance Activities, Continued

Current Status

LLNL RP&IE functions are currently described in the Annual Work Plan and Staffing Plan, both of which are used for maintenance planning. The Annual Work Plan includes identified PM activities, planned overhauls, repairs, and replacements, anticipated routine work, and allowances for unscheduled work requests (approximately 45,000 per year).

Better planning methods and techniques are being developed and implemented to improve Laboratory-wide maintenance data collection and coordination of maintenance planning and scheduling activities. Anticipated changes in the Work Control System, Material Control, Facility Condition Inspection Program, and the integration of existing database systems (see Figure A-1), where possible, will greatly enhance the overall planning and scheduling system. Interfaces for sharing maintenance-related data and coordination of maintenance activities between all functional areas require enhancement.

Scheduling for planned and unplanned maintenance repairs and alterations is presently provided through several automated systems that are controlled and maintained by functional maintenance areas. Currently, these systems are not fully integrated, and work activities are not completely coordinated among functional areas. Some of the existing systems are inadequate, and others cannot be integrated into a single maintenance scheduling system.

Planned Improvements

Our planned improvements are as follows:

- Continue with the planned enhancements to integrate all maintenance elements (e.g., work control, facility condition assessments, database systems, etc.) of the Maintenance Management Program
- Add resources commensurate with anticipated needs as a result of proposed changes in the planning and scheduling process
- Develop or enhance existing procedures and guidance documents, as required, for proper implementation as changes evolve
- Provide appropriate training
- Revise current planning and scheduling procedures to meet DOE Order 4330.4B, Maintenance Management Program, requirements
- Implement the improved planning process to increase maintenance effectiveness for program operations

Continued on next page

Real Property and Installed Equipment, Continued

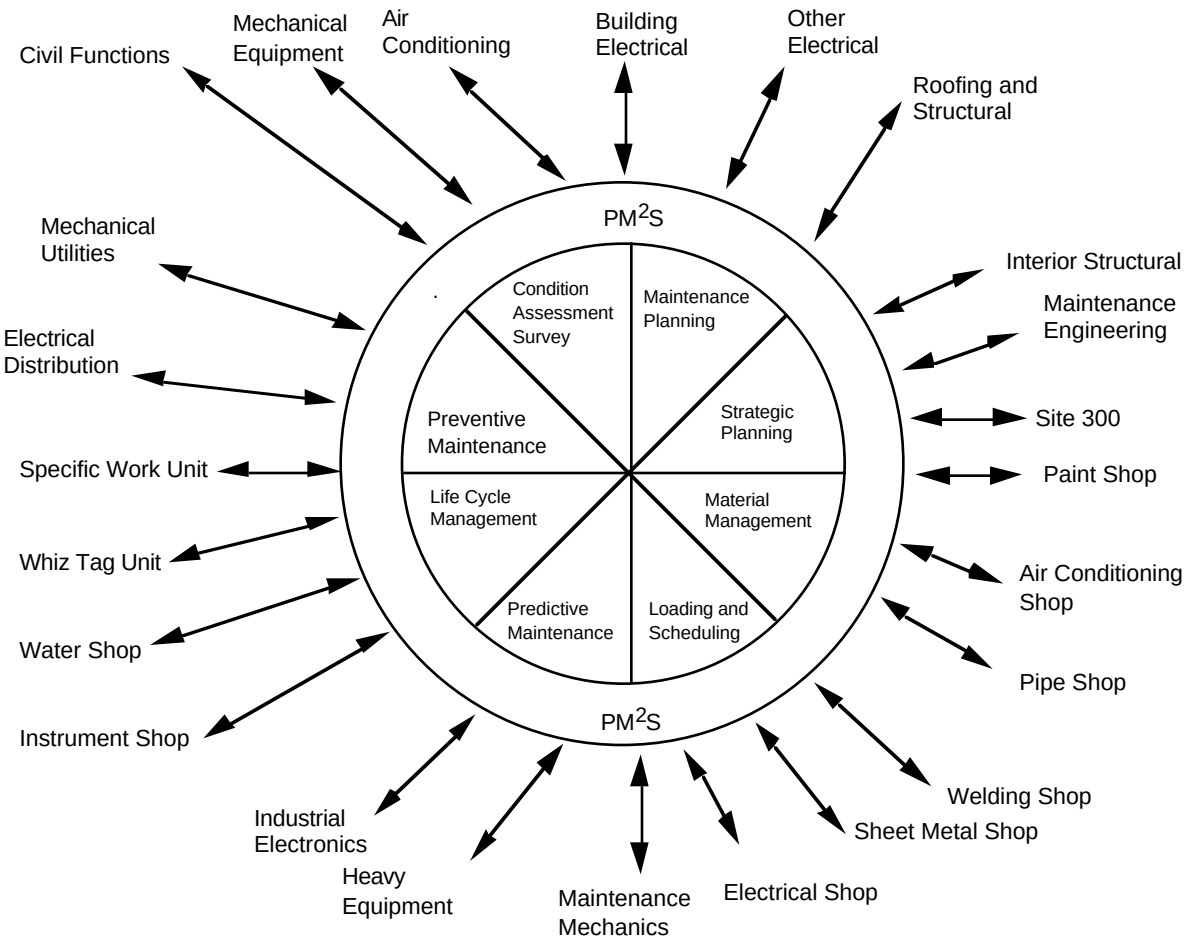

Figure A-1. Integration of Databases.

Continued on next page

Real Property and Installed Equipment, Continued

Scheduling Maintenance Activities

Objective

Our objective is to schedule all identified and anticipated maintenance work on a predetermined basis using a graded approach. We will:

- Provide interdepartmental support as necessary to meet established schedules.
- Perform maintenance according to a uniformly established single-priority system with emphasis on safety-related structures, systems, and components. Priorities should be assigned and controlled by the facilities and closely coordinated with affected organizations.
- Provide methods for coordination of required radiation work permits (as described in Facility Safety Procedures) in the work-control process.
- Ensure, through the Work Control System, that all other required permits such as fire, burn, or sprinkler water outage permits are identified and obtained prior to work beginning.
- Provide methods to identify, procure, and obtain parts, materials and tools needed to perform maintenance activities.

Current Status

A major percentage of maintenance work performed for LLNL facilities is currently scheduled through periodic meetings between maintenance and operations personnel. A window concept is used to schedule and perform PM and other maintenance-related activities. A time frame for the window schedule is mutually established between the M/O Department and the facility for PM work based on existing and planned organizational requirements.

Planned Improvements

We will continue to use our current scheduling system while expanding the use of the maintenance windowing concept. By increasing our communication links with the Program Facility Managers through scheduled meetings, attendance at working groups, etc., we will be in a better position to determine program needs and desires and the role that maintenance can play in meeting those needs.

Continued on next page

Real Property and Installed Equipment, Continued

Coordination of Maintenance Activities

Objective

Our objectives are as follows:

- Coordinate maintenance activities to promote the efficient use of resources within a scheduling structure that can respond to both established and unscheduled priorities.
- Ensure that all affected organizations and activities are considered and effectively integrated to meet Laboratory maintenance needs.
- Provide the flexibility to schedule unexpected work requirements based on historical data and trending techniques (e.g., percentage of scheduled to unscheduled work completed).

Current Status

Detailed maintenance scheduling, including overall site coordination and support from other organizations, needs to be enhanced. Communication issues and coordination activities for the MIP have a common focal point provided by CAMO.

Planned Improvements

The M/O Department will establish a system to coordinate maintenance activities based on Laboratory-wide policies and procedures.

Outage Planning, Scheduling, and Coordination

Objective

Our objective is to plan, schedule, and coordinate utility outages with all affected parties in order to minimize the impact on programmatic functions.

Current Status

Planning and scheduling of outages appears to be adequate at the present time; however, coordinating and scheduling nonoutage maintenance activities during planned outages needs improvement. These improvements will evolve as planned initiatives and changes in the work control, planning, scheduling, and work coordination processes are implemented, especially in the use of life-cycle planning and long-range maintenance planning. Statistical process control and analysis training is also planned for managers and supervisors.

Continued on next page

Real Property and Installed Equipment, Continued

Outage Planning, Scheduling, and Coordination, Continued

Planned Improvements

We plan to establish procedures to enhance coordination of outage maintenance activities to ensure:

- Nonoutage maintenance activities are identified and scheduled to take place during planned outages.
- Adequate resources including material and personnel are available to support additional planned maintenance activities.

8. Control of Maintenance Activities

Management-directed and -delegated involvement in control of maintenance activities should ensure that maintenance practices are effective in maintaining safe and reliable facility operation.

Rigorous control of maintenance activities should be directed toward achieving high-quality work performance, personnel safety, equipment and system protection, and facility safety and reliability.

Our response to this element is discussed under the following subsections:

- Work control procedure
- Work request
- Supervision of maintenance activities
- Review of completed work request
- Temporary Repairs
- Control of nonfacility personnel

Work Control Procedure

Objective

Our objective is to identify facility deficiencies and needed work We will avoid redundant identification of these deficiencies and guide the accomplishment of work and subsequent post-maintenance activities through clear and concise procedures or instructions.

Continued on next page

Real Property and Installed Equipment, Continued

Work Control Procedure, Continued

Current Status

Currently, RP&IE work control is centralized within the M/O Department and is administered by individual functional area managers. Work-control procedures and documentation have been standardized within the Production Control Organization and are outlined in the Plant Engineering *PM_2S Manual*. A Maintenance Planning data system has been established to collect, store, and retrieve information pertaining to identified deficiencies or maintenance work needed in the facilities. However, procedures and practices that fully use the applications of contemporary analysis techniques need to be improved.

Planned Improvements

We plan to maintain continuous improvement practices in the area of work control. We will improve the applications of analysis techniques.

Work Request

Objective

Our objective is to provide a work control document to initiate all facility maintenance activities. We will use these documents to clearly define the work to be performed, applicable prerequisite requirements and data, or information needed to track, evaluate, and support other maintenance elements (e.g., spare parts, material control, and equipment history) as work is completed. These documents should include information such as:

- Work procedures, instructions, and references
- Job priority
- Safety and radiation protection requirements
- Limiting conditions for operation
- Authorization and review signatures
- Equipment identification
- Post-maintenance testing requirements

Continued on next page

Real Property and Installed Equipment, Continued

Work Request, Continued

Current Status

Maintenance work of RP&IE is initiated through work requests, work orders, and a whiz tag program, which are controlled by each functional area manager. Information to be collected during work activities and data needed to support integral elements (e.g., maintenance history and spare parts) of the Maintenance Management Program have not been clearly defined, standardized, or consistently applied. The absence of an integrated work control data system prevents the effective collective tracking of maintenance data required to perform accurate analyses or effectively implement other maintenance management techniques.

Planned Improvements

We plan to develop an integrated work control data system. We will review and evaluate work request content requirements. We will also standardize work request documentation requirements for all functional areas.

Supervision of Maintenance Activities

Objective

Maintenance supervisors should monitor work in progress to ensure that maintenance activities are being conducted in accordance with DOE and facility-specific policies and procedures. Supervisors who have maintenance responsibility for Category 1 systems should make periodic inspections of designated systems and their associated areas to ensure proper maintenance is being conducted safely and efficiently.

Current Status

Current practices and staffing levels do not allow sufficient time for maintenance supervisors to conduct work-site visits to effectively monitor and assess work in progress.

Planned Improvements

We will implement the following improvements:

- Evaluate ways to increase the frequency of work-site visits and improve the observation techniques of assigned supervisors and management personnel
- Develop monitoring criteria and evaluation techniques

Continued on next page

Real Property and Installed Equipment, Continued

Supervision of Maintenance Activities, Continued

Planned Improvements, Continued

- Provide checklists or other appropriate means to document observations of work in progress
- Have maintenance supervisors schedule visits and monitor work in progress on a periodic basis using a graded approach

Review of Completed Work Request

Objective

Supervisors in functional maintenance areas should routinely monitor completed work requests to ensure that all maintenance activities are properly completed and documented. Using the concept of the graded approach, post-job reviews should be conducted to evaluate and critique the work performed and to provide feedback to planning, scheduling, and maintenance personnel. Lessons learned and recommended improvements should be factored into ongoing processes to encourage continuous improvements in quality workmanship and Laboratory-wide maintenance.

Current Status

Current staffing levels and assigned workloads prevent adequate or in-depth reviews of completed maintenance work by the first-line supervisor. Administrative tracking systems provide limited methods to flag anomalies and institute follow-up of supervisory or management review activities.

Planned Improvements

We plan to establish a percentage of time that first-line supervisors are expected to spend monitoring maintenance activities. We will evaluate supervisory administrative work loads and adjust them accordingly to allow sufficient time for work-site supervision and post-job reviews. We will supplement supervisory follow-up with methods to receive and document customer feedback on the adequacy of completed work.

Temporary Repairs

Objective

All temporary repairs should be performed under the provisions of a facility temporary modification program.

Continued on next page

Real Property and Installed Equipment, Continued

Temporary Repairs, Continued

Current Status

The facility temporary modification program is presently inadequate. See the discussion under Element 18 for further information and our planned improvements.

Control of Nonfacility Personnel

Objective

Provision should be made to ensure that nonfacility contractors are trained and qualified for the maintenance work they are to perform.

Current Status

Qualification, verification, and control of RP&IE nonfacility contractors is currently under the direction of the M/O Department, and the individual Facility Manager or designee is responsible for proper indoctrination prior to authorizing facility access. Documentation of nonfacility contractor qualifications is inconsistently applied Laboratory-wide.

Planned Improvements

Facility Managers will continue to provide facility access indoctrination and to implement quality assurance requirements to ensure nonfacility contractors possess the required knowledge and skills to perform the work assigned. We will include a requirement for documentation of nonfacility contractor qualifications in the purchase specifications.

9. Post-Maintenance Testing

Post-maintenance testing should be performed to verify that components will fulfill their design function when returned to service after maintenance.

A post-maintenance test program includes specifying, performing, documenting and accepting the post-maintenance testing. The graded approach will be applied to the application of post maintenance testing.

Objective

Our objective is to perform post-maintenance testing within the facilities to verify that safety-related structures, systems, and components, as well as other equipment, will fulfill the design functions when returned to service after maintenance.

Continued on next page

Real Property and Installed Equipment, Continued

9. Post-Maintenance Testing, Continued

Current Status

Limited post-maintenance testing (PMT) following maintenance in the facilities is currently performed on selected safety systems as prescribed in *PM_2S Manual* procedures. Testing is done on a case-by-case basis. Formal documentation of post-maintenance test selection, performance, data and evaluation requires improvement. Design baseline information and as-built drawing enhancements will be necessary to support the PMT program.

Planned Improvements

We plan to establish a formal program to expand, control, and document post-maintenance testing. We will enhance existing administrative procedures to support formal documentation and integration of post-maintenance testing initiatives into maintenance procedures. This program will be a part of the maintenance work-control system.

10. Procurement of Parts, Materials, and Services

Proper parts and materials in good condition are necessary to maintain design requirements for maintenance activities during normal facility operations and to support both planned and unplanned outages. Services are periodically needed to provide unique or supplementary maintenance support. An effective procurement process should be developed in conjunction with the quality assurance requirements of DOE Order 5700.6(series) to ensure that parts, materials, and services are available when needed.

Objective

Parts, materials, and services required for maintenance activities should be available when needed.

Appropriate controls should be established and channels provided for purchasing quality parts, materials, and services from reliable suppliers as necessary to support planned, routine, and emergency facility maintenance requirements.

Continued on next page

Real Property and Installed Equipment, Continued

10. Procurement of Parts, Materials, and Services, Continued

Current Status

As part of LLNL's commitment to CQI, the Procurement Department has implemented a complete Procurement Process Rebuild Project. This project has been structured as a total systems approach that will incrementally upgrade, streamline, and institutionalize contemporary operational precepts and procurement processes. When implemented, the Procurement Department will be able to fully meet the intent of DOE Order 4330.4B, Maintenance Management Program, UC Contract 48, and applicable federal laws.

The operational areas addressed in the Procurement Process Rebuild Project are:

- Acquisition planning
- Source selection
- Pricing and negotiation
- Subcontract administration
- Management control

Current Status

Enhancements in each operational area will generally be broken down into four phases:

1. **Full Requirement Assessment**—The assessment phase involves a full evaluation of existing procurement-related laboratory systems, consultation with industry experts, consultation with the DOE, and site visits to other facilities.
2. **Design and Development**—This phase includes all activities required to define the new business systems necessary to meet the goals of the rebuild project.
3. **Document**—The documentation phase includes the preparation of manuals, desk guides, user guides, training materials, and other implementation support documentation.
4. **Implement**—The implementation phase includes outreach, training, testing, revisions, and ongoing maintenance of systems established during the project.

The Procurement Process Rebuild Project has been fully documented in the draft Contractor Business Management System Review (CBSR) Action Plan. This document contains specific details of the project as well as projected completion dates.

Continued on next page

Real Property and Installed Equipment, Continued

10. Procurement of Parts, Materials, and Services, Continued

Planned Improvements

Our planned improvements are as follows:

- Continue the incremental development and implementation of the Procurement Process Rebuild Project
- Supplement and update the existing LLNL Procurement Manual, Volumes 1 and 2, as development efforts are completed
- Document and communicate evolving changes to all affected parties through memoranda, manuals, and other appropriate forms of documentation
- Provide training to procurement and other facility personnel, as necessary, to effectively implement the enhanced procurement process
- Provide guidance and instructions in facility-specific or department-specific subtier documents, as necessary, to achieve compliance with evolving procurement policies and procedures applicable to Procurement Initiation, Procurement Control, and Procurement Services requirements of DOE Order 4330.4B, Maintenance Management Program

11. Material Receipt, Inspection, Handling, Storage, Retrieval, and Issuance

LLNL personnel involved in the Supply and Distribution (S&D) operation should be aware of the correct process to receive, inspect, handle, and store facility material and equipment so that it is easily retrievable and usable when needed. Policies and procedures must be understood by S&D personnel and other organizations that interface with the S&D operation, such as Procurement, Quality Assurance, Engineering, Hazards Control, Programs, Safety, and Maintenance.

Objective

All phases of receiving, inspecting, handling, storing, retrieving, and issuing equipment, parts, and materials for maintenance should be covered by effectively implemented policies and procedures consistent with Quality Assurance requirements from the time an item is received until it is installed in the facility.

Current Status

At the present time, parts, materials, and components are received, warehoused, and issued through a material control system that has proven to be reasonably responsive and effective in meeting the needs of the Laboratory. The S&D Department consists of two main divisions:

Continued on next page

Real Property and Installed Equipment, Continued

Current Status, Continued

1. The Supply Division is responsible for having materials available for Laboratory maintenance needs.
2. The Material Distribution Division is responsible for delivering materials to the end users.

The Supply Division has a Central Stores facility and over 150 satellite substores established Laboratory-wide to facilitate accessibility and expedite material delivery to appropriate personnel.

LLNL's current procedures for material receipt, inspection, handling, storage, retrieval, and issuance are described below.

Material Integrity and Quality

Material integrity and quality is maintained through a process that classifies material into the following three categories:

1. Stock items
2. Nonstock items
3. Total fabrication items

Stock item requirements and characteristics are documented and supported by quality standards that have been developed for all of the approximately 28,000 stock items maintained for facility use.

Nonstock and total fabrication parts, components, and materials are processed through the LLNL procurement cycle. Requirements and characteristics for these items are normally documented in the purchase request and are determined by the requesting organization. Specification requirements have been established and guidance is provided to initiators in the LLNL Plant, Electronic, and Mechanical Engineering Standards.

Receipt Inspection

Receipt inspection for stock items is performed by Central Receiving. Nonstock and fabrication items undergo an initial inspection by Central Receiving with respect to parity of materials received with the Bill of Lading. Actual receipt inspection and acceptance is determined and conducted by the user organization.

Continued on next page

Real Property and Installed Equipment, Continued

Current Status, Continued

Receipt Inspection, Continued

Damaged items are identified and labeled as "DISTRESSED." Distressed items are isolated in a manner that precludes inadvertent use or installation. Disposition of the distressed stock items is determined by the Supply Division. Disposition for nonstock or fabricated items is determined by the Procurement Department.

Inventory Control

Inventory control is maintained through periodic inventories, usage records, and trending techniques. Justification documentation is required when requested materials exceed established par levels.

Applicable controls and guidance for the handling and storage of stock items are in place. Handling and storage requirements for nonstock and fabricated items require improvement.

Adequate controls are in place to ensure proper retrieval and issuance of materials to the appropriate organization.

Planned Improvements

LLNL recognizes that improvement or enhancements to current operational processes are needed in several areas in order to meet the intent of DOE Order 4330.4B, Maintenance Management Program. These specific areas are:

- Material specifications
- Spare parts

LLNL will develop procedures which will incorporate planned enhancements and improvements in these areas as well as other related areas of the Material Control process. The development schedule will depend on the evolution and maturity levels of other planned MIP improvements that have an interrelationship or interdependency (i.e., Master Equipment List to the Spare Parts Program) with each other. Additionally, applicable requirements of DOE Order 5700.6C, Quality Assurance, will be incorporated in appropriate guidance documents. Incremental development of procedures will ensure that the proper materials are available and in serviceable condition to meet facility maintenance requirements.

Continued on next page

Real Property and Installed Equipment, Continued

12. Control and Calibration of Measuring and Test Equipment

Objective

The program for control and calibration of measuring and test equipment (M&TE) should be consistent with Quality Assurance requirements and ensure the accurate performance of facility instrumentation and equipment for testing, calibration, and repairs.

The control and calibration of M&TE should ensure the accurate performance of facility instrumentation and equipment for testing, calibration, and repairs.

Current Status

A M/O M&TE procedure for RP&IE has been developed and issued. As currently written, it establishes the identification, calibration standards, procurement, control, storage, and documentation of M&TE in accordance with DOE Order 4330.4B, Maintenance Management Program.

The centralized tool crib and the automated Tool Inventory Control and Tracking System (see the discussion under Element 13) will provide the necessary storage, calibration scheduling, usage documentation, and controls required for calibrated M&TE, which is stored and maintained by the facility.

Usage documentation and reviews of maintenance performed with suspected defective or unreliable M&TE is minimal. The proposed tool program will provide a means for both documentation of usage and will provide data for maintenance reviews or failure analyses.

Planned Improvements

Our planned improvements are as follows:

- Identify the M&TE to be included in the RP&IE M&TE program for calibration
- Designate a storage location for controlled M&TE in the tool crib
- Maintain a Master M&TE List, including the calibrated M&TE controlled by the facilities
- Establish a formal, calibrated M&TE control and tracking program system until applicable M&TE can be input into the automated Tool Inventory Control and Tracking System

Continued on next page

Real Property and Installed Equipment, Continued

13. Maintenance Tools and Equipment Control

Objective

Methods should be established to provide for storage, issuance, and maintenance of an adequate and readily available supply of tools and equipment and also for the development of special tools and equipment needed in the maintenance program.

Maintenance tools and equipment control addresses the need for an effective program in order to accomplish maintenance activities effectively and efficiently. Our response to this element is discussed under the following subsections:

- Storage and issuance
- Tool and equipment maintenance
- Use of special tools and equipment

Storage and Issuance

Current Status

Not all functional areas have a tool control system in place. Each M/O maintenance shop has a tool allocation and is currently responsible for tool purchases, upkeep, storage, and control. An automated Tool Inventory Control and Tracking System has been requisitioned and is currently in the procurement cycle. A centralized tool crib location for M/O activities has been established for storage and control of tools and equipment.

Planned Improvements

Before the automated Tool and Inventory Control and Tracking System is received and fully implemented, we plan to take incremental steps to make the transition to the new automated system easier. We will also develop a procedure to cover tool crib activities.

Tool and Equipment Maintenance

Current Status

Shop tools and equipment are currently maintained by the shops in which they are located. Installed equipage is tested, inspected, and certified in accordance with state standards.

Planned Improvements

The LLNL RP&IE Facility Condition Inspection Program is progressing in a satisfactory manner and is in continuous improvement mode.

Continued on next page

Real Property and Installed Equipment, Continued

Special Tools and Equipment

Current Status

Craftworkers using forklifts and cranes are trained and certified by the Hazards Control Department. Riggers are approved by Plant Engineering to conduct lifts. Rigging used for critical lifts must be tested and tagged at least every three years and recertified prior to each critical lift. Rigging used for ordinary lifts is currently tested on an as-needed basis.

Planned Improvements

For cost effectiveness and compliance, we plan to maintain a percentage of rigging maintained strictly for critical lifts. This rigging should have current load tests and tags. The Automated Tool Inventory Control System should be used to maintain the retest schedules and rigging use records.

14. Facility Condition Inspection

Objective

Management should conduct periodic inspections of equipment and facilities to assure excellent facility condition and housekeeping.

Periodic inspections of RP&IE should be conducted on a scheduled basis to ensure excellent facility systems and equipment are maintained at a level to support safe and reliable operation. Our objective is to continually improve facility inspection program.

Current Status

Currently, the routine facility inspections of RP&IE is implemented using a combination of CAS and M/O Department inspections and surveys. Inspection efforts are scheduled based on life expectancy, future plans, ES&H concerns, available funds, and personnel. The results are held in the LLNL Maintenance Planning System. This allows maintenance activities to be coordinated with deficiency profile requirements. Classifying activities by correction year and funding year clearly defines how maintenance dollars should be used.

Planned Improvements

We plan to continue to improve the current inspection and survey effort.

Continued on next page

Real Property and Installed Equipment, Continued

15. Management Involvement

To ensure the safety of DOE nuclear facility operations, DOE and contractor corporate and facility managers should be sufficiently involved with facility operations to be technically informed and personally familiar with conditions at the operating facility.

Management actively provides direction, training, and resources to ensure excellence of product. For facilities to operate efficiently, effectively, and safely, all levels of management must communicate their goals throughout their organizations. The following section, Maintenance Systems Monitoring, addresses management involvement, performance indicators, goals, and objectives, and feedback. Program reviews are addressed under the Maintenance Program Review and Assessment, which follows.

Our response to this element is discussed under the following subsections:

- Maintenance systems monitoring
- Maintenance program review and assessment

Maintenance Systems Monitoring

Objective

Our objective is to provide adequate management monitoring in the form of personal involvement, performance indicators, goals and objectives, and feedback to ensure that maintenance systems function effectively.

Current Status

Motivated first-line supervisors routinely visit job sites to observe, recognize, and guide the craftworkers. Upper management makes unscheduled visits when activities permit. These visits allow management to receive direct feedback about how well work goals are communicated and to supplement ongoing improvements identified by the craftworkers in the field. Feedback is continually solicited through work group organizations, open door policies, brown bag lunches, and informal discussion groups. CQI initiatives, such as the "bubble up process," brainstorms, fishbone analysis, etc., have established a means to identify areas requiring improvement and through established trending indicators, progress in meeting the objectives are measured.

Continued on next page

Real Property and Installed Equipment, Continued

Maintenance Systems Monitoring, Continued

Planned Improvements

We plan to implement the following improvements:

- Continue routine job site visits and work reviews at facilities.
- Establish a simple method for recording observations of both positive features of existing processes and areas that need improvement.
- Use these observations to improve processes.
- Formally identify in policy manuals, procedure manuals, or quality assurance plans, as appropriate, the points addressed in Element 15 of DOE Order 4330.4B, Management Involvement, to assist in consistent implementation at all facilities.
- Continue implementation of the CQI process.

Maintenance Program Review and Assessment

Objective

Our objective is to measure maintenance program effectiveness through inspections, audits, reviews, investigations and self-assessments. Data collected should be used to improve existing programs.

Current Status

There are existing informal programs that cover most aspects of this element. Assessments of facility condition and worker practices during maintenance are conducted through informal management tours. After they return to the field, craftworkers provide little feedback on the training they received to assess its relevance or effectiveness. The majority of training feedback is provided in the form of course critiques conducted during the training session. The procurement program is undergoing an across-the-board upgrade (see Element 10). Formal assessments in this area are part of the upgrade project.

Planned Improvements

We plan to establish a formal mechanism to ensure triennial reviews of the maintenance program elements associated with facility condition, worker practices during maintenance, maintenance training, procurement activities, and M&TE.

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Real Property and Installed Equipment, Continued

16. Maintenance History

Objectives

A maintenance history and trending program should be maintained to document data, provide historical information for maintenance planning, and support maintenance and performance trending of facility systems and components.

An effective maintenance history and trending program is necessary to establish the retrieval, analysis, and use of equipment, component, and system information to improve facility reliability.

Current Status

Limited equipment history is currently maintained for RP&IE at LLNL. An evaluation and determination of specific equipment and components to be included in the program, based on a graded approach, is being conducted for some facilities. Standardization of documentation and tracking requirements needs to be completed. DOE Order subsections, Program Development, Data Collection, and Program Use, are discussed collectively below under Program Development.

Planned Improvements

We plan to identify maintenance history documentation requirements and improve existing data systems to facilitate the capture, storage, and retrieval of historical information for maintenance equipment and system analysis and trending. We will evaluate effective ways to improve the Maintenance History Program through enhancements in the work control system (see Element 8).

Program Development

Objective

The Maintenance History Program should provide for documentation of component identification and description, vendor information, diagnostic monitoring data, corrective and preventive maintenance, modification information, and spare parts data. Access to this information should be provided to maintenance work groups.

Current Status

The M/O Department maintains limited maintenance history information for RP&IE. Standardized documentation requirements for capturing applicable equipment history data need to be improved. Data use has not been fully implemented.

Continued on next page

Real Property and Installed Equipment, Continued

Program Development, Continued

Planned Improvements

We plan to standardize documentation requirements for capturing applicable maintenance and equipment history data. We will enhance or develop a system to direct the use of equipment performance, reliability, and dependability data for developing PM schedules, maintaining the appropriate level of spare parts, and serving as a viable tool for plant life extension applications and analysis techniques.

17. Analysis of Maintenance Problems

System analysis should be used to determine and correct root causes of unplanned occurrences related to maintenance.

Our response to this element is discussed under the following subsections:

- Information collection
- Event analysis
- Cause determination
- Corrective action
- Correction action follow-up

Information Collection

Objective

Our objective is to collect data on unplanned occurrences that affect safety or reliability and are of a recurring nature. We will include the maintenance and operational history of the component, diagnostic information, training of personnel, and other information relating to the unplanned event.

Current Status

The M/O Department has developed procedures that provide guidance for the information collection process. The information developed and collected through maintenance analysis should be used as input into the maintenance history program.

Planned Improvements

We plan to include the integration of applicable data into the maintenance history program.

Continued on next page

Real Property and Installed Equipment, Continued

Event Analysis

Objective

Our objective is to use the information collected for maintenance analysis to reconstruct the unplanned event. We will identify apparent causal factors and categorize them into human- or equipment-performance problems.

Current Status

The M/O Department's Maintenance Engineering Group has a developed procedure that provides guidance for the event analysis process. This procedure has been partially implemented.

Planned Improvements

We plan to integrate the event analysis data into the maintenance history program.

Cause Determination

Objective

Our objective is to evaluate the actual or probable causes of a problem by one or more techniques or methodologies (i.e., event and causal factor charting, fault-tree analysis, change analysis, barrier analysis, etc.) to establish a final root cause.

Current Status

The M/O Department has developed procedures that provide guidance for the cause-determination process. These procedures have been partially implemented. Root-cause information should be used as input into the maintenance history program.

Planned Improvements

We plan to input root-cause analysis data into the maintenance history program.

Corrective Action

Objective

Following determination of the root cause, our objective is to develop, execute, and track to completion a corrective action plan (i.e., maintenance request for repair, changing frequency of preventive maintenance, counseling personnel, and modifying the training program).

Continued on next page

Real Property and Installed Equipment, Continued

Corrective Action, Continued

Current Status

Guidance documents mention the need for corrective actions but do not provide detailed guidance for developing, executing, and tracking a corrective action plan.

Planned Improvements

The guidance document (MOP-00006) will be revised to include procedures for developing, executing, and tracking corrective action plans.

Corrective Action Follow-up

Objective

Our objective is to perform post-maintenance tests, retests, or close monitoring of the operation for a period of time following corrective action. Similarly, we will perform long-term follow-up when corrective actions such as retraining, procedural changes, and preventive maintenance changes are necessary.

Current Status

Current maintenance analysis documents mention the need for follow-up actions but provide minimal guidance concerning long-term follow-up activities. Additionally, the program does not address the development of generic corrective action plans.

Planned Improvements

The M/O Department plans to initiate a program that provides guidance to post-maintenance tests and retests following corrective maintenance after an unplanned event or failure. See the post-maintenance test program in Element 9. Long-term follow-up activities and generic corrective action plans will be included in this program enhancement.

18. Modification Work

Objective

Facility modification work, including temporary modifications, should be accomplished under the same basic administrative controls as those applied to facility maintenance activities so that there are no increases in risk to facility equipment, environment, or personnel because of the modification work.

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Real Property and Installed Equipment, Continued

18. Modification Work, Continued

Objective, Continued

Temporary repairs or modifications should be evaluated, documented, and controlled in a manner commensurate with the original requirements established for, and restrictions imposed on, the item being repaired or modified. Temporary repairs or modifications should receive a safety review prior to implementation to ensure the adequacy of the repair and its effect on personnel safety and equipment reliability.

Current Status

Currently, temporary repairs and modifications to RP&IE are accomplished through the Plant Engineering Department using appropriate controls and standards. Anticipated enhancements in the CFMP, including identification of components and equipment that fall under the purview of the CFMP, will assist in developing specific controls, guidelines, and processes to ensure proper communication and interfaces among all affected parties. Future maintenance activities (e.g., PM and overhauls) applicable to modifications are not adequately addressed at the present time. A Configuration Management Program is currently under development to support maintenance of RP&IE and other related functions. A model of the anticipated Configuration Management (CM) program is presented in Figure A-2.

Planned Improvements

We plan to make the following improvements:

- Continue to develop a CM Program
- Use a graded approach based on the safety classification of the equipment or component as specified and identified in the CFMP
- Include the evaluation of future maintenance requirements resulting from repairs or modifications in the review process
- Develop a comprehensive Temporary Modification Program that is guided by CM to ensure proper reviews, approvals, work completion, tracking, and future maintenance planning

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Real Property and Installed Equipment, Continued

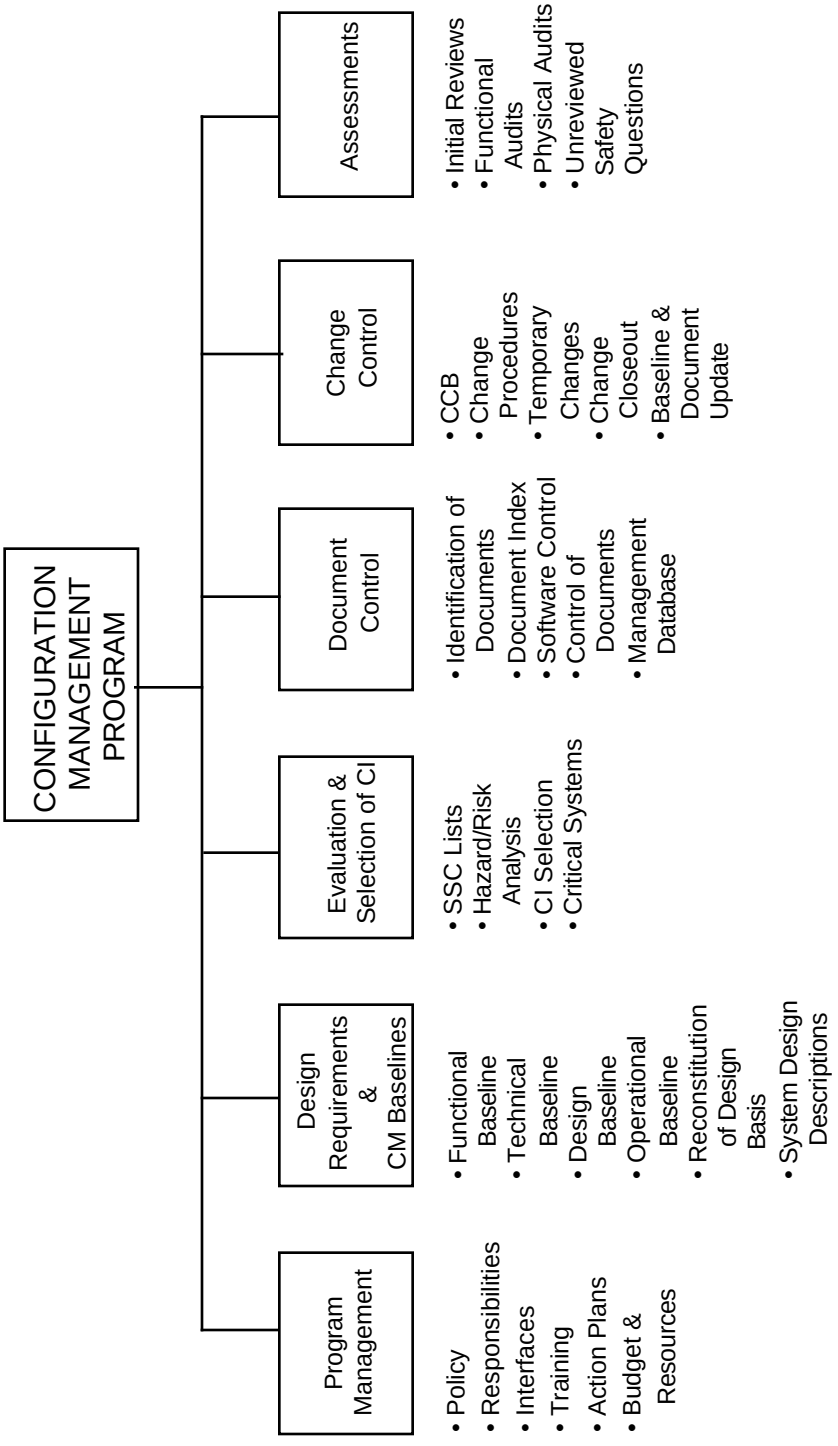

Figure A-2. Configuration Management Plan.

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Real Property and Installed Equipment, Continued

19. Additional Maintenance Management Requirements

A program should be in place to prevent equipment and building damage due to cold weather at any nuclear facility that may be at risk.

During December 1990, LLNL sustained significant damage to facility air-conditioning systems, fire sprinkler systems, and outdoor plumbing because of weather freeze conditions. As a result of the damage, Plant Engineering assessed the systems that were most affected by the freeze and developed a Freeze Protection Plan.

Objective

Our objective is to provide proper compensatory measures to protect facilities against the cold.

Current Status

There is a four-month window during the year that the Laboratory is susceptible to freeze damage. The Freeze Protection Plan is designed to take action prior to, during, and after the freeze window. It is a graded-approach plan that provides most intensive protection in the third of three progressively more severe freeze conditions.

Planned Improvements

We plan to place program into a continual improvement mode.

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Appendix B
Nuclear Facilities

Introduction

We have developed an appendix for each nuclear facility as specified by the letter from Dennis Fisher, Associate Director Plant Operations, Lawrence Livermore National Laboratory (LLNL) to Warren W. Warner, Director Laboratory Operations Division, Department of Energy (DOE), San Francisco Field Office dated April 1, 1993. We used DOE-STD-1027-92 as the guide for identifying and classifying nuclear facilities. If additional facilities are identified as nonreactor nuclear facilities, we will develop similar appendices for them.

In this Section

This section presents the Maintenance Implementation Plans for Nuclear Facilities at LLNL. These include:

Facilities that Formerly Housed Nuclear Material

Several facilities at LLNL no longer house nuclear material and therefore do not need Maintenance Implementation Plans. These include:

- Building 239
- Building 255E
- Building 343
- Building 812E

Appendix B.1
Building 231 Maintenance Implementation Plan

Facility Description

The Building 231 vault is located in the 1300 wing of Building 231. It is operated by the Materials Management section of Mechanical Engineering, Engineering Science Department. The vault consists of five areas, designated as follows:

- Room 1345 is the entrance.
- Room 1351 is receiving, shipping, inspection, and certification of nonnuclear Nuclear Explosive-Like Assemblies (NELAs).
- Room 1330 West and East are storage of sealed sources.
- Rooms 1323 through 1329 are mechanical equipment rooms that house the high-efficiency particulate air (HEPA) filter systems.
- Room 2300 Fan Loft (Mechanical Equipment) houses the air supply and exhaust fans.

Purpose

The operation of Building 231 vault is limited to the shipping, receiving, inspecting, weighing, packaging, on-site transportation functions, certification of nonnuclear NELAs, intermediate-term storage of radioactive sealed sources, and storage of controlled materials. Controlled materials are defined in the Lawrence Livermore National Laboratory (LLNL) *Health and Safety Manual,* Chapter 8, and include PU-239, U-235, and U-233 fissile materials.

Operations

All employees shall work according to the requirements of Facility Safety Procedure (FSP) 233, Revision June 1993, applicable Operations Safety Procedures (OSPs), the *Health and Safety Manual,* and *Environmental Protection Handbook*. Supervisors are responsible for assuring that safety procedures are followed within their program areas. Employees are expected to take all reasonable precautions to protect themselves and fellow employees, and to perform only those tasks that can be safely accomplished.

Major Programmatic Activities that May Involve Radioactivity

Major programmatic activities that may involve radioactivity are as follows:

- Receiving (from outside agencies and internal programs)
- Shipping (to other agencies or internal programs)
- Opening, inspecting, and repackaging
- Storage of sealed sources

Continued on next page

Building 231 Maintenance Implementation Plan, Continued

Self Assessment

To address the elements in Chapter II of Department of Energy (DOE) Order 4330.4B, Maintenance Management Program, we performed an informal self assessment of Building 231, 1300 Area, using the graded approach. The six risks and their rating are:

Risk to:	Category	Discussion
Public Safety	3	No public impact.
Laboratory Workers	3	Possibility of minor injury or illness.
Environment	3	Damage to the environment is limited to the immediate area around the facility and requiring minimal cleanup.
Safeguards and Security	4	No loss of special nuclear material or secure data.
Mission/ Economic Impact	3	Damage to the facility or process will not impact its mission or deplete program resources.
Level of Maintenance	4	Good business and maintenance practice, economic benefits, and prudence. Systems limited to repair and recurring preventive maintenance on installed equipment.

The worst case failure involves the equipment fans. If exhaust fans FHE 63 and 64 fail, the pressure in the 1300 (vault) area becomes positive, sounding an alarm. If the supply fan fails, the pressure in the area becomes negative, and the doors become difficult to open. If either occurs, the vault is evacuated until the problem is rectified. Hazards Control checks for contamination before reentry.

The results of the above graded risk rating approach indicated that this nuclear storage facility is of low importance. The present Plant Engineering preventive maintenance program on real property and installed equipment (RP&IE) should continue. There is no personal property and programmatic equipment (PP&PE) associated with this nuclear facility.

Our self assessment for each of the elements in DOE Order 4330.4B, Maintenance Management Program, is presented below.

2. Maintenance Organization and Administration

Plant Engineering will document their maintenance policy and communicate the maintenance requirements to the Facility Manager, emphasizing the environment, worker safety, and the documentation requirements of maintenance.

Continued on next page

Building 231 Maintenance Implementation Plan, Continued

3. Training and Qualification of Maintenance Personnel	As a low-importance nuclear facility, Plant Engineering will continue its present maintenance training and qualification program to ensure that the skills and knowledge required by maintenance personnel are developed and maintained.
4. Maintenance Facilities, Equipment, and Tools	Special tools or training are not required; equipment is standard throughout the Laboratory (see Element 5 below) .
5. Types of Maintenance	Equipment that is important for health and safety of environment and workers includes: • Two interlocked fume hood exhaust fans • One supply air fan (RP&IE) • Accompanying HEPA filter systems The fans are connected to building emergency power generators. Preventive and predictive maintenance should be maintained at the same present level.
6. Maintenance Procedures	Plant Engineering will maintain its present preventive maintenance system.
7. Planning, Scheduling, and Coordination of Maintenance	Additional formal planning of maintenance is not required because crafts follow their established preventive maintenance plan.
8. Control of Maintenance Activities	Formalized controls are not required for maintenance activities because the equipment is located is in a locked area (in compliance with a Plant Engineering roof policy procedure).
9. Post-Maintenance Testing	The requirements for post-maintenance testing are covered in Plant Engineering's Maintenance System MOP-00 document. Formal documentation of post-maintenance testing is not maintained by the facility because there are no safety systems.
10. Procurement of Parts, Materials, and Services	As a low-importance facility, Plant Engineering purchases all parts for equipment as described in Element 5.

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Building 231 Maintenance Implementation Plan, Continued

Elements 11 Through 13

Elements 11 through 13 are not required for this facility. These include:

- Material Receipt, Inspection, Handling, Storage, Retrieval, and Issuance
- Control and Calibration of Measuring and Test Equipment
- Maintenance Tools and Equipment Control

14. Facility Condition Inspection

As a low-importance facility, management conducts uninformed and nondocumented walk-through periodic inspections.

15. Management Involvement

The Materials Management Section Leader and Facility Manager, in agreement with Environment, Safety, and Health Team Leader, will approve all maintenance service and alteration work in the areas with hoods, according to Facility Safety Procedure 233, Revised June 1993.

16. Maintenance History

Plant Engineering is responsible for keeping records of all maintenance activities and history. The Facility Coordinator maintains and updates the following:

- Plant Engineering and program equipment lists
- Facility schematics of:
  - Air supply and exhaust systems
  - Sprinkler system
  - Electrical system
  - Water system
  - Air sampling, radiation monitoring, and alarm systems
- Modification work by Plant Engineering on programmtic equipment

17. Analysis of Maintenance Problems

This element is not required for a low-importance facility. Plant Engineering's maintenance history, kept as part of their preventive maintenance work, will provide this information on RP&IE equipment.

18. Configuration Management Modification Work

Modifications or repairs will be evaluated by facility management before they are implemented to ensure their efficacy and to determine the effects on personnel safety and equipment reliability.

Appendix B.2
Building 233 Maintenance Implementation Plan

Maintenance Plan Not Required

The operation of Building 233 storage vault is a secured storage area for controlled material consisting of classified waste, classified parts, low-level radiation, and precious metals except special nuclear material. Maintenance activities do not apply to this structure because there is no personal property and programmatic equipment (PP&PE) associated with its operation. Maintenance of real property and installed equipment (RP&IE) associated with this vault will follow procedures outlined in Appendix A. As a result, a maintenance plan for PP&PE is not required.

Appendix B.3
Building 251 Maintenance Implementation Plan

Summary

This Maintenance Implementation Plan (MIP) describes Lawrence Livermore National Laboratory's (LLNL's) planned approach to maintenance in Building 251, the Heavy Element Facility, in response to the Department of Energy (DOE) Order 4330.4B, Maintenance Management Program, Chapter II. The element-by-element discussion follows the description of the facility.

Facility Description

The Heavy Element Facility's historical technical mission was the safe and efficient handling of transuranic elements used in support of LLNL's programs and basic research. It was operated by the Nuclear Test–Experimental Science Directorate's Nuclear Chemistry Division for diagnostic analysis associated with the underground testing of nuclear devices and basic research devoted to a better understanding of the chemical and nuclear behavior of the transuranic elements. Since the end of underground testing, the facility has been engaged primarily in inventory reduction and clean-up operations as it makes the transition to cold standby status.

The facility was constructed in eight increments. Increment One became operational in the Spring of 1956 and Increment Seven in the Fall of 1968. In 1979 to 1980, Increment Six was modified, and part of Increment Three was upgraded to withstand an earthquake having a 0.8 g acceleration (0.5 g $\times$ 1.6 safety factor) and a design basis fire of two hours duration. This upgraded portion of the building is referred to as the "hardened area." Increment Eight, an escape corridor, was added in 1980.

The facility is a one-story, windowless (except for four offices) structure, approximately 63 m (207 ft) $\times$ 45 m (149 ft) with a gross floor area of about 2,800 m^2 (30,100 ft^2). There is a mezzanine structure in Increment Seven that extends over approximately one-fourth of the first floor. The building contains 29 LLNL work areas, seven offices, seven mechanical equipment rooms, four storage rooms, six industrial or service shops, caves, a hot cell area, pool, two change rooms, hallways, and restroom facilities.

Facility Status

As of January, 1995, the facility has been operating with a staff of six (Facility Manager, Building Coordinator, Mechanical Technician, Health and Safety Technician, Janitor, and Secretary) which is engaged in cleanup, inventory reduction, and documentation. The facility is in warm standby mode transitioning to the cold standby mode. These modes are defined in the B-251 Safety Analysis Report (SAR) below.

Continued on next page

Building 251 Maintenance Implementation Plan, Continued

Warm Standby

Warm standby is defined as follows:

> A MODE in which the function of the facility is not being performed and most of the process equipment is de-energized or disabled. In-process SNM or hazardous material is placed in an overnight safe configuration. Overnight safe configuration is within glove boxes, hot cells, or vaults in fixed arrays so that the material would be safe in walk-away conditions. No SNM or hazardous material processing, handling, or transfers are allowed, except for removal or change to a safer configuration. Removal of waste is permitted. Systems that are normally at high energy conditions shall be returned to low energy conditions.

Cold Standby

Warm standby is defined as follows:

> A MODE in which SNM and hazardous material has been removed from the process lines and most of it placed in storage. Quantities still in the facility are present only in physically stable form and in essentially an immobile, protected, and safe favorable geometry configuration. The transfer or movement of (inventory) *out* of the facility is allowed. Removal of waste from the facility is allowed. It is expected that single rather than redundant engineered safety trains or safety systems shall be adequate for this mode, or that some safety systems may be de-energized. A revised surveillance and maintenance plan may be prepared for this mode.

Engineered safety systems identified in the SAR continue to have routine maintenance while the facility is in standby status. Surveillance requirements found in the SAR technical safety requirements (TSRs) are included as part of routine maintenance. Maintenance of programmatic equipment is limited to only those systems required to assure that the facility remains in a safe configuration.

The building inventory of radionuclides is stored primarily in underground storage vaults. However, some material remains in safes, glove boxes, caves, and hoods.

Continued on next page

Building 251 Maintenance Implementation Plan, Continued

Objective

The objective of the maintenance program is to ensure the operability of Building 251 structures, systems, and components important to safety, to ensure worker and public safety, and to confine radioactive and hazardous materials within proper boundaries. Maintenance and surveillance (inspection) of safety systems and equipment will be covered by this program and by a Maintenance and Surveillance Plan to be developed by the responsible directorate and support organizations.

Building Safety Systems

The Building Safety Systems have been identified in the SAR and the Facility Safety Procedure (FSP). They are:

- Emergency generators
- Fire protection system, glove box exhaust system, and fume hood exhaust system

In addition, there are other engineered safety systems including the room exhaust system, air and stack monitoring systems, and communication and alarm systems that must receive maintenance in order to ensure the safety envelope for the facility.

Each of the elements in DOE Order 4330.4B, Maintenance Management Program, are discussed in the following sections.

2. Maintenance Organization and Administration

The Facility Associate Director or designee is responsible for the facility's maintenance program. Specific areas and levels of responsibility and authority for maintenance activities will be defined with the support organizations in the Maintenance and Surveillance Plan to be developed for Building 251. Should a new mission be defined for the facility, the new facility management will develop a long-term maintenance strategy plan and revise this supplement to the LLNL MIP.

3. Training and Qualification of Maintenance Personnel

The support organizations that provide the workers who perform maintenance activities ensure that personnel assigned to work in Building 251 are technically competent for their job assignments and properly trained for the task to be performed. The principal support organization for maintenance is Plant Engineering, while Hazards Control maintains detection and monitoring equipment and the fire protection system.

Continued on next page

Building 251 Maintenance Implementation Plan, Continued

4. Maintenance Facilities, Equipment, and Tools

If requested by maintenance personnel and agreed to by the Facility Manager, maintenance tools and equipment for specific maintenance jobs may be stored in the facility. Because this is not an operating facility, support organizations will provide the equipment and tools to perform their work. Although Building 251 has two machine shops, an assembly shop, and a mechanical supply room, they are not available to support facility maintenance activities while the facility is in standby mode.

Building 251 has a fenced area for outside staging and the Increment 7 high-bay for inside staging. There is a decontamination shower in Building 251.

5. Types of Maintenance

Equipment requiring preventive maintenance has been identified in the SAR and FSP, as well as by the facility staff using the graded approach. A Master Equipment List being developed by the facility staff with assistance from the support organizations. Support organizations provide maintenance for real property and installed equipment (RP&IE) and, under agreement with facility management, for some personal property and programmatic equipment (PP&PE).

Corrective maintenance for both RP&IE and PP&PE performed by the support organizations is scheduled by the Building Coordinator.

Predictive maintenance for RP&IE is recommended and performed by the maintenance organizations

Each support organization schedules its own maintenance activities with the Building Coordinator. Plant Engineering preventive maintenance is conducted during quarterly “windows” where as many activities as possible are scheduled to be performed during a period of three to five days.

6. Maintenance Procedures

The maintenance and surveillance plan will include agreements with support organizations to provide for maintenance of RP&IE and PP&PE in the standby mode. Support organizations are responsible for providing procedures for maintenance of installed equipment as well as for identified programmatic equipment.

Should specialized programmatic equipment require maintenance by facility staff, procedures developed by the manufacturers will be used or appropriate procedures will be written.

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Building 251 Maintenance Implementation Plan, Continued

7. Planning, Scheduling, and Coordination of Maintenance	Maintenance activities are planned by the support organizations in conjunction with the Facility Manager and Building Coordinator. Plant Engineering conducts preventive maintenance windowing, which allows much of the preventive maintenance to be performed at one time. Maintenance work that includes exposure to radiation is planned within As Low As Reasonably Achievable (ALARA) guidelines.
8. Control of Maintenance Activities	The work control for Building 251 is an administrative control to ensure that technical support personnel are briefed on any pertinent environmental, safety, and health issues, including the hazards in the specific work location, to ensure that work is completed and to allow for acceptance of the work.
9. Post-Maintenance Testing	The Building Coordinator is responsible for determining when post-maintenance testing is required and ensuring that required post-maintenance testing is performed. Requirements are based on the TSRs and the graded approach to ensure that equipment important to safe and reliable facility operation in the standby mode is properly maintained. As new requirements are identified, they will be included in procedures written by the support organizations.
10. Procurement of Parts, Materials, and Services	The procurement of parts, materials, and services to maintain equipment required to assure the safety envelope of the facility is primarily the responsibility of support organizations performing the maintenance. In some cases the responsibility lies with the Facility Manager. These parts, materials, and services will be acquired according to the policies and procedures of LLNL and the responsible organization.
11. Material Receipt, Inspection, Handling, Storage, Retrieval, and Issuance	At the present time, low-value commodities (parts, materials, components, and fabrication items) used by the Laboratory for common-use applications are purchased for inventory at LLNL. These materials are received, warehoused, and issued through an inventory control system, managed by the Supply and Distribution Department (S&D). Nonstock and total fabrication parts, components, and materials are processed through the LLNL procurement cycle. Requirements and characteristics for these items are normally documented in the purchase request and are determined by the requesting organization guidelines.

Continued on next page

Building 251 Maintenance Implementation Plan, Continued

12. Control and Calibration of Measuring and Test Equipment	Measuring and test equipment (M&TE) is controlled and calibrated by the support organization that uses the equipment. The support organizations maintain records for issue and recall. When an M&TE device is found to be unreliable or out of calibration, that item will be removed from service as soon as possible, and replaced with an approved device. Programmatic M&TE required in waste generation will be calibrated and maintained by the Facility Manager or designee.
13. Maintenance Tools and Equipment Control	Tools, equipment, and ladders needed for work in the facility will be brought to the facility by the support organizations. As stated in Section 4, they may be stored in the facility under agreement with the Facility Manager. Tools and equipment will be checked for contamination prior to removal from the facility.
14. Facility Condition Inspection	Facility condition inspections will be conducted as specified in the self-assessment plan of the directorate having responsibility for Building 251. The LLNL Nuclear Facilities Safety Office provides institutional safety oversight of LLNL nuclear facilities and periodically performs appraisals of the physical condition of the facility.
15. Management Involvement	The Facility Associate Director has appointed a Facility Manager to ensure that the facility is maintained in a safe configuration while in standby mode. This individual informs the Associate Director or designee of the fiscal requirements for maintaining the building as well as any maintenance problems.
16. Maintenance History	Facility management relies on subject matter experts to maintain the systems. The history of the structures, systems, and components of the facility are documented in Plant Engineering and facility records.
17. Analysis of Maintenance Problems	Maintenance problems identified by facility management are reviewed with the pertinent maintenance organization. If a maintenance problem results in a reportable occurrence, Section 4 of LLNL's *Health and Safety Manual* specifies actions to take to conform to the requirements of DOE Orders 5000.3B, Occurrence Reporting and Processing of Operations Information, and 5484.1. In addition, LLNL offers a course on occurrence reporting. Building 251 management conforms to these requirements in performing systematic analysis for unplanned occurrences.

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Building 251 Maintenance Implementation Plan, Continued

17. Analysis of Maintenance Problems, Continued

The Facility Manager is responsible for maintaining an awareness of maintenance problems and for working with the appropriate support organization to provide any corrective action required.

18. Modification Work

Modifications are not expected while the facility is in standby mode; however, if modifications are required before changing to a higher mode, additions or modifications to the facility and its equipment shall be formally authorized by the Facility Associate Director or designee. Any modifications involving a safety issue requires a review committee. Configuration management will be included in this review. Major modifications may require documentation of an Unresolved Safety Question as outlined in Supplement 2.21 of the *Health and Safety Manual* (September, 1994.)

19. Additional Maintenance Management Requirements

Building 251 has had a program in place that is operated in conjunction with Plant Engineering's Freeze Protection Plan (issued December 13, 1991).

References

1. *Safety Analysis Report for the Heavy Element Facility* (Building 251), UCRL-AR-113377 (September 30, 1994). Approved by DOE December 20, 1994.
2. *Facility Safety Procedure* (FSP) 251 (July 1993).
3. *B-251 Training Implementation Matrix/Training Plan* (September 1993).

Modifications to Implementation Schedule

Due to staff limitations and devotion of resources to inventory reduction and cleanup, a revised implementation schedule is provided below.

Task	Description	Completion Date
1.5/1.6	Submit revised Building 251 MIP to Capital Assets Management Office	February 15, 1995
2.1	Apply graded approach to identified Category 1, 2, and 3 systems	April 30, 1995
2.2	Identify maintenance requirements for Category 1 and 2 equipment and develop Master Equipment List	August 31, 1995

Appendix B.4
Building 255E Maintenance Implementation Plan

Maintenance Plan Not Required

Building 255E no longer houses nuclear materials and has been delisted as a nuclear facility; therefore, it does not require a maintenance plan.

Appendix B.5
Building 331 Maintenance Implementation Plan

Summary

This Maintenance Implementation Plan (MIP) describes Lawrence Livermore National Laboratory's (LLNL's) planned approach and improvements in response to each of the elements listed in Department of Energy (DOE) Order 4330.4B, Maintenance Management Program. The element-by-element discussion follows the facility description.

Facility Description

LLNL's Tritium Facility is located in Building 331. This facility has been downsizing from a 300g to a 5g tritium inventory limit, although downsizing was delayed following an accidental release of about 120 Ci of tritium on April 2, 1991. When downsizing activities resumed in July through October of 1991, operators and the Facility Manager concluded that the existing tritium handling systems had degraded sufficiently that further use of them would pose an unacceptable risk. A design team was formed and mobilized, and dedicated tritium removal equipment was designed and built in order to reduce the tritium inventory to zero prior to redirection. The removal equipment will be used within the Radioactive Materials Area (RMA).

Facility Layout

The total floor area of Building 331 is 2,425 m^2 (26,120 ft^2). Approximately half of this area is devoted to the RMA. The RMA is constructed of reinforced concrete. Supply air systems to the RMA shut off in the event of a fire. Both supply and exhaust air to the RMA and the stack exhaust of the RMA are on emergency power. Emergency power is also provided for all RMA alarm systems and monitors, stack monitors and alarms, building emergency lighting, fire alarm system, and telephone system. Three types of tritium monitors measure, indicate, and alarm if there is a tritium release within the RMA. They are stack monitors, room monitors, and hood monitors. An uninterruptible power system (UPS) assures continuous power to the stack and room monitor electronics.

Building 331 does not have a dedicated control room. Indication and alarm functions are contained in an alcove off the main corridor, at the entrance to the RMA outside Room 1124. Indication functions include stack (totaled and instantaneous) and room radioactive concentration levels. Alarm functions include radioactive emissions, fire detection, tritium room radiation monitors, ventilation loss, security, and UPS failure. Alarms to the fire and security departments are sent over dedicated telephone lines.

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Building 331 Maintenance Implementation Plan, Continued

Facility Status

The facility is currently in a standby configuration. All ventilation systems, monitors, and alarm systems continue to function and have had routine maintenance during standby status. The summed inventory of tritium in Building 331 as of February 1, 1994 rounds to 3.7 g: about 2.6 g in hydride form on palladium and uranium beds, 0.53 g in HTO form on mole sieves, and 0.64 g is bound on a titanium sponge. The largest single concentration is in hydride form on palladium bed PCPD 2 in Room 153. Building tritium inventory is summarized in monthly reports from materials management.

The facility's chemical laboratories are no longer in operation. Remaining quantities of potentially hazardous chemical substances are listed in Table 4-1 in Section 4.0 in the building Facility Safety Procedure (FSP) dated April 1993.

Facility Purpose

Facility Strategic Plan

The tritium facility provides a state-of-the-art, low-level tritium and radioactive waste research and development capability, focused in the near term on legacy waste and decontamination projects, and serving to maintain LLNL tritium expertise. The facility will support low inventory experiments to a 5 g facility maximum and other selected nontritium low level radioactive waste activities.

Operations and Material Requiring a Supplemental Operational Safety Procedure

Operations and material requiring a supplemental Operational Safety Procedure (OSP) include the following:

- Tritium Inventory Removal (TIR) Project.
- No operation involving fissile materials, except as sealed sources with less than 1 g of fissile material are allowed without a Supplemental OSP.
- No explosives or propellants, other than small arms ammunition carried by Protective Services Officers, are permitted in the building without a Supplemental OSP.
- All other operations meeting the selection criteria of *Health and Safety Manual,* Section 2.06.
- As necessary, determined by the Facility Manager.

Continued on next page

Building 331 Maintenance Implementation Plan, Continued

Facility Operation

The TIR Project consists of two phases. During Phase I, specially designed equipment of the TIR Project taps into existing tritium manifolded systems at carefully predetermined locations to remove the documented amount of tritium gas within. During Phase II, this equipment is used to systematically search the remaining systems to verify that all tritium, other than trace surface contamination, has been removed. Completion of Phase I and Phase II readies the facility for redirection.

The TIR Project requires that all building safety systems function but does not require that previously used tritium systems of Building 331 function. Previously used tritium systems of Building 331 will be used minimally in the TIR Project; the existing equipment serves as the vessels from which the tritium inventory is to be extracted.

New building users have not yet been identified, and so their needs remain unknown. The dismantling and disposal of tritium-contaminated hardware requires different equipment and procedures than those designed for the TIR Project. If decontamination and decommissioning of the tritium facility is required to meet new user needs, then these processes will be addressed in additional safety documentation as appropriate for that project.

2. Maintenance Organization and Administration

The objectives of the Facilities Maintenance Management Program policies are to:

- Place primary emphasis on public and worker safety
- Provide required oversight coordination and direction for all facility maintenance activities through the Facility Manager
- Establish and communicate clear and concise maintenance policies to all affected personnel
- Designate the Facility Manager as the single point of contact responsible for the overall quality of the maintenance program
- Develop and direct a cost-effective and efficient Maintenance Management Program
- Minimize occurrences as defined in DOE Order 5000.3B, Occurrence Reporting and Processing of Operations Information
- Ensure the maintenance program effectively supports the LLNL mission
- Ensure the maintenance program is environmentally sound
- Promulgate and implement maintenance policies through instructions and guidance provided in procedures, manuals, and other pertinent documents

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Building 331 Maintenance Implementation Plan, Continued

Maintenance Strategy

Long-Term Maintenance Strategy

Because the facility is currently in a laboratory-by-laboratory decommissioning, decontamination, and redeployment phase, the appropriate long-term maintenance strategy cannot be specified yet. As the future direction clarifies, however, Facility Managers will develop a long-term maintenance plan.

Current Interface With Support Organizations

The Facility Coordinator is responsible for coordinating all aspect of services provided by maintenance support.

Facility-Specific Technical Competence

It is Plant Engineering's responsibility to ensure that assigned maintenance personnel are technically competent and document such records. The Facility Coordinator must verify that maintenance personnel have all required facility special training required for the task to be performed. The Facility Hazards Control Technician is responsible for special facility training and will keep all records related to special facility maintenance training.

3. Training and Qualification of Maintenance Personnel

If facility training is required for a task it can be requested by any Plant Engineering or facility personnel. The Facility Hazard Control Technician will perform a Tritium Awareness Training Class for maintenance personnel if it is required for the task and if the maintenance personnel have not had the class within one year. It is the responsibility of the Hazards Control Technician to record and audit these training records. Any additional facility training required will be requested by the Facility Hazards Control Technician or the Facility Manager.

On-The-Job Training

It is Plant Engineering's responsibility to ensure that personnel assigned to do all maintenance tasks in the facility have been adequately trained to perform the specific maintenance task. It is the Facility Coordinator's responsibility to ensure that the maintenance personnel have the adequate facility-specific training required for the task being performed.

4. Maintenance Facilities, Equipment, and Tools

If requested by maintenance personnel and the facility agrees with the maintenance personnel's request, the facility will provide and store maintenance tools and equipment for specific maintenance jobs.

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Building 331 Maintenance Implementation Plan, Continued

5. Types of Maintenance

The types of maintenance are outlined as follows:

1.0 Master Equipment List

1.1 Building Safety Systems (Graded Category 2)

Room, stack, and hood monitors
Tritium alarms
Main and hood exhaust fans
Emergency power generator
Automatic electrical power transfer switch and system
UPS system
Smoke/heat detection system
Fire detection/suppression systems
Emergency paging system
Ventilation air supply systems
Emergency phones

1.2 Building Nonsafety-Related Systems (Graded Category 3)

Chillers
Boilers
Increment 1 and 2 roof and overhang (Over the RMA)
All emergency exits
All emergency lights
Air handler ACU4 (Office area adjacent to RMA)

2.2 Building Nonsafety-Related Systems (Graded Category 4)

Circulation pumps
Water heaters
Lights
House air
Building gas and electricity
Building water and sewer systems
Building air handlers (except ones Graded Category 2)

Continued on next page

Building 331 Maintenance Implementation Plan, Continued

6. Maintenance Procedures

There are currently no tritium process systems that require preventive maintenance from Plant Engineering.

Maintenance personnel are responsible for creating the maintenance procedure. Before maintenance is performed on any building safety system, the Facility Manager and Facility Coordinator must approve the maintenance procedure. After approval, the Facility Coordinator will alert the maintenance personnel of any additional precautions that may need to be taken and verify that the maintenance personnel have all valid facility training required to complete the task. After the maintenance is completed, the Facility Coordinator must review the task summary sheet, sign, and date it. It is the maintenance personnel's responsibility to alert the Facility Coordinator of any deficiencies.

The Facility Manager may require a Radiological Work Permit (RWP) before certain maintenance activities are performed. This will be completed by maintenance personnel and facility personnel. The RWP is a facility document and can be obtained from the Facility Manager.

7. Planning, Scheduling, and Coordination of Maintenance

All maintenance scheduling must be scheduled through the Facility Coordinator. As Low As Reasonably Achievable (ALARA) and building projects may affect the availability of building safety systems and some areas of the facility.

The facility has recently decided to try maintenance windowing in an effort to help maintenance personnel and the facility be more cost and time efficient. This will address some but not all maintenance activities at the facility.

Procurement of Parts and Material

The facility reserves the right to request special requirements, certifications, and inspections on any procured parts, material, and services required by the facility.

Completed Job Documentation Requirements

In addition to post-maintenance testing, the facility will conduct random audits of maintenance performed by Plant Engineering. The Facility Coordinator will keep a detailed hard copy or computer copy of the maintenance task summary and corrective action taken (if required) for one year.

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Building 331 Maintenance Implementation Plan, Continued

8. Control of Maintenance Activities	Maintenance activities will be controlled as follows: • Maintenance windowing will help control maintenance activities. • Maintenance personnel are required to inform facility personnel prior to doing any maintenance in the facility. • Required facility training will be verified by the Facility Coordinator.
9. Post-Maintenance Testing	The facility can at any time request post-maintenance testing on any building system. Post-maintenance testing is required if the Facility Manager believes it is necessary, and it will be considered for any task involving level of maintenance Category 1 or 2 equipment.
10. Procurement of Parts, Materials, and Services	See Procurement of Parts and Material under Element 7 above.
11. Material Receipt, Inspection, Handling, Storage, Retrieval, and Issuance	See Procurement of Parts and Material under Element 7 above.
12. Control and Calibration of Measuring and Test Equipment	Programmatic management is responsible for ensuring that equipment used to collect data and/or monitor the results of scientific or engineering investigations is adequately maintained and calibrated to assure the integrity and defensibility of the technical results. For test equipment used by plant maintenance, this function is assumed by plant line management. Calibration and maintenance of equipment or systems shall be in accordance with Calibration and Maintenance Policies and Procedures. The facility will require documentation that all measuring and test equipment is traceable to National Institute of Standards and Technology.
13. Maintenance Tools and Equipment Control	The facility safely store any facility specific special tools required by maintenance personnel.

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Building 331 Maintenance Implementation Plan, Continued

14. Facility Condition Inspection	The Alcove Monitors report the status of most building safety systems. It is the maintenance personnel's responsibility to check all Category 2 facility systems and assure they are operating properly once every off-shift and once each weekend day and holiday. If a building Category 2 system fails during the off-hour shifts, on the weekend, or on a holiday, it is maintenance personnel's responsibility to respond to the failure, notify building personnel, and follow their instructions. Building personnel must be contacted if any non-Category 2 system fails and it is noticed by maintenance personnel and is a hazard or potential hazard. If it is not a hazard or potential hazard a signed note with a description of the failure must be left for the Building Coordinator. The Facility Coordinator is responsible for assuring all reported deficiencies are corrected.
15. Management Involvement	The Facility Manager must be informed of any Category 2 system maintenance.
16. Maintenance History	Plant Engineering should keep records of all real property and installed equipment (RP&IE) maintenance activities. The Facility Coordinator will keep maintenance records on safety systems for one year and personal property and programmatic equipment (PP&PE) equipment indefinitely, as needed.
17. Analysis of Maintenance Problems	The Facility Coordinator will keep records of any unplanned occurrence that are of recurring nature and occur during maintenance activities. Reoccurring occurrences will be analyzed by building personnel until a solution is developed and the corrective action is taken. The Facility Coordinator will keep records of all corrective actions taken. The corrective action record will be stored until it is determined that there is no threat of reoccurrence.
18. Modification Work	Permanent and temporary modification work performed in the facility will be approved by the Facility Manager. It is the Facility Manager's responsibility to assure that the modification is done in a safe manner and is no threat to personnel, equipment, and the environment.
19. Other Maintenance Considerations	Plant Engineering will provide freeze protection for all cold weather sensitive systems.

Appendix B.6
Building 332 Maintenance Implementation Plan

Summary

The original purpose of Building 332, the Plutonium Facility, was to conduct metallurgical and chemical research on plutonium and uranium in support of the nuclear weapons Research, Development, and Testing Program. In the past, the facility also supported the research and development (R&D) on laser isotope separation of plutonium. Current programmatic activities include:

- Device fabrication to support the Laboratory's Nuclear Design Program
- Development of plutonium-bearing engineering assemblies for the Military Applications Program
- Development of improved or unique plutonium fabrication techniques
- Basic and applied research in plutonium metallurgy

In addition, the demonstration of pyrochemical plutonium processes are performed for Department of Energy's (DOE's) nuclear materials production complex. In support of the plutonium R&D activities, the facility maintains the safe and secure storage of plutonium and other special nuclear materials (SNM).

This facility-specific Maintenance Implementation Plan (MIP) contrasts the overall maintenance program for Building 332 with the Maintenance Management Program elements described in Chapter II of DOE Order 4330.4B, Maintenance Management Program. An element-by-element description follows the facility description and describes how the elements of Chapter II of the DOE order will be applied to real property and installed equipment (RP&IE) and to personnel property and programmatic equipment (PP&PE). RP&IE is maintained by the central maintenance organization using craftworkers, while PP&PE is normally maintained by the operating organization that owns the property.

Facility Description

Confinement for radioactive materials are provided by three barriers:

1. Metal storage containers and gloveboxes, with associated exhaust ventilation/ high-efficiency particulate air (HEPA) filters, provide the primary confinement barriers.
2. The secondary confinement barrier consists of the rooms (compartments) in the radioactive materials areas (RMA) of Increments 1 and 3 and by the associated room exhaust ventilation/HEPA filtration systems.
3. A third confinement barrier is provided by the concrete building structure and the airlocks.

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Building 332 Maintenance Implementation Plan, Continued

Facility Description, Continued

The building became operational in 1961 and consists of two structurally independent sections with a passageway between them. Increment 1, which is the oldest and largest section of Building 332, is two stories high. Offices, laboratory work areas, craft shops, mechanical equipment room, change rooms, and a storage vault are on the first floor. The second floor (loft area) houses part of the ventilation system (exhaust fans, motors, and HEPA filters) for Increment 1. A nearby (but separate) Plenum Building houses the remaining part of the Increment 1 ventilation system.

Increment 3 was added to the east side of Building 332 in 1977. This increment consists of one floor at ground level and a basement. Several plutonium handling laboratories are located on the ground floor. The increment's ventilation equipment, together with storage tanks for emergency fire-sprinkler-system water, emergency power, utilities, and support equipment for experiments conducted in Increment 3 are contained in the basement. The total area of Building 332 is 9,066 m^2.

Facility Organization

The facility has a matrix organization to ensure the safe and reliable operation of the facilities by establishing a strong maintenance philosophy and culture designed to achieve excellence in maintenance. The successful application of standards, values, and convictions requires a team effort and a dedicated commitment to a maintenance plan that encourages continuous quality improvement.

2. Maintenance Organization and Administration

The goal in this element is accomplished by establishing policies, goals, objectives, and the accountability needed in facility maintenance. The Facility Manager has maintenance oversight responsibility. Maintenance policy is described in the Plutonium Facility Maintenance and Operations Manual (M-246, Revision 1) and establishes the maintenance requirements for the operating organizations.

This element is addressed in the following subsections:

- Maintenance program policies
- Long-term maintenance strategy
- Interfaces

Maintenance Program Policies

The objectives of the Facilities Maintenance Management Program policies are to:

- Place primary emphasis on public and worker safety

Continued on next page

Building 332 Maintenance Implementation Plan, Continued

Maintenance Program Policies, Continued

- Provide required oversight coordination and direction for all facility maintenance activities through the Facility Manager
- Establish and communicate clear and concise maintenance policies to all affected personnel
- Designate the Facility Manager as the single point of contact responsible for the overall quality of the maintenance program
- Develop and direct a cost-effective and efficient Maintenance Management Program
- Minimize occurrences as defined in DOE Order 5000.3B, Occurrence Reporting and Processing of Operations Information
- Ensure the maintenance program effectively supports the LLNL mission
- Ensure the maintenance program is environmentally sound
- Promulgate and implement maintenance policies through instructions and guidance provided in procedures, manuals, and other pertinent documents

Long-Term Maintenance Strategy

Long-term maintenance strategy is based on the following tasks:

- Promote effective working relationships and better communication among all organizational units that support maintenance functions
- Establish performance indicators relating to maintenance support effectiveness
- Solidify and implement an effective facility inspection assessment
- Improve use of facility and systems inspection results
- Identify and develop additional operating maintenance procedures
- Document work appropriately
- Use work and equipment analysis data to improve maintenance operations

Interfaces

Implementation of the MIP will require the following interfaces within LLNL:

- Plant Engineering provides support to achieve all the goals previously designated. Craftworkers are provided to perform the maintenance activities in accordance to facility-approved procedures. Technical support is provided to perform facility inspections, root-cause analysis for equipment failures, and full-documentation reports to the facility staff. Notification of all maintenance-related activities are presented to the facility for quality assurance and safety review.

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Building 332 Maintenance Implementation Plan, Continued

Interfaces, Continued

- Hazards Control provides support to achieve all the designated goals. Technicians are provided to perform maintenance for all facility-related equipment related to radiation control in accordance to facility-approved procedures. Technical support is provided to perform facility inspections, root-cause analysis for equipment failures, and full-documentation reports to the facility staff. Notification of all maintenance-related activities are presented to the facility for quality assurance and safety review.
- Mechanical Engineering, Electronics Engineering, and Chemistry organizations provide support to enhance programmatic performance. Technicians are provided to perform maintenance for programmatic equipment in accordance to facility-approved procedures (usually designated in Operational Safety Procedures—OSPs). Notification of all maintenance-related activities are presented to the facility for quality assurance and safety review.

3. Training and Qualification of Maintenance Personnel

Responsibilities for all aspects of training (identification of needs, development, funding, implementation, documentation, etc.) are clearly defined and communicated.

The *Facility Training Plan* defines responsibilities for establishing, maintaining, and implementing site training programs. Maintenance organizations are responsible for providing technicians and craftworkers with base skills to perform any activity authorized by Facility Safety Procedures (FSPs) or OSPs. Specific training for access and handling of radioactive activities are provided by the facility.

This element is addressed in the following subsections:

- Maintenance training program
- On-the-job training
- Training in root-cause analysis
- Management and supervisory training

Maintenance Training Program

The objective of the Maintenance Training Program is to provide structured, performance-based training where necessary to personnel engaged in maintenance and maintenance support (e.g., planning, engineering, and warehousing) activities.

The Facility Manager has designated the Facility Training Officer as responsible for assuring that workers are qualified for their assignments. The training office shall maintain facility-specific training and provide lists of qualification status.

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Building 332 Maintenance Implementation Plan, Continued

On-The-Job Training	The objective of on-the-job training (OJT) is to develop and maintain a formal, documented OJT program, based on job and task analysis, that will support the training and qualification of maintenance personnel. Our current OJT program is effective.
Training in Root-Cause Analysis	The objective of training in root-cause analysis is to instill an effective root-cause determination attitude toward equipment failures through comprehensive root-cause analysis training. Currently, training in root-cause analysis is available only for a limited group of facility personnel.
Management and Supervisory Training	The objective of management and supervisory training is to develop highly capable maintenance managers by augmenting their technical training with management and supervisory skills training. The management and supervisory training program is implemented.
4. Maintenance Facilities, Equipment, and Tools	The current status of maintenance facilities, equipment, and tools is as follows: • **Laydown and Staging—**Internal and external laydown and staging areas are not clearly identified. Provisions have been made for moving and storing materials to comply with applicable DOE orders. • **Storage Facilities—**Storage facilities are inadequate: (1) to perform adequate inventory or provide appropriate access, or (2) the facilities do not allow proper environmental conditions for storage. • **Temporary Facilities and Decontamination Facilities—**Work performed on a program with potential radioactive contamination hazards is controlled by the facility-specific programs. Decontamination shower facilities are properly maintained and available in the facility. • **Tool and Equipment Storage—**Currently, each maintenance shop maintains its own tools inventory which provides closer proximity to the work locations. Special tools are provided as required for the programmatic use.

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Building 332 Maintenance Implementation Plan, Continued

5. Types of Maintenance

This element is discussed under the following subsections:

- Master Equipment List
- Corrective maintenance
- Preventive maintenance
- Predictive maintenance
- Maintenance action and frequency selection

Master Equipment List

A detailed master list of both safety-related and nonsafety-related equipment, components, and structures will be included in the maintenance program.

Several independent Master Equipment Lists exist in various levels of detail. Special tools and equipment are not included.

Corrective Maintenance

When corrective maintenance is necessary, failed equipment will be repaired expeditiously to minimize unscheduled facility downtime. We will ensure that corrective actions meet all safety and operations needs.

Appropriate priorities are presently placed on corrective maintenance activities. During an emergency or where nonroutine maintenance is required, all activities must follow the Emergency Response procedure. This procedure describes the level of effort, agreements on the maintenance to be completed (including signatures for the craftworkers and facility management), post-maintenance checks, and final approval. Administrative controls are the responsibility of facility management and any use thereof must have written authorization.

LLNL's objective is to reduce the frequency of corrective maintenance actions through:

- Aggressive preventive and predictive maintenance programs
- Effective use of root-cause-of-failure analysis techniques

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Building 332 Maintenance Implementation Plan, Continued

Preventive Maintenance

The objective of preventive maintenance is to perform maintenance that will maximize the equipment life cycle while maintaining required availability.

LLNL uses timed frequencies to provide preventive maintenance (PM) tasking to specified equipment. The PM program uses checklists as guides for the on-site mechanic to ensure specified parts and operations are checked and conditions recorded. Only the work listed: (1) in the guide or work order, or (2) minor repairs (less than one hour) are to be performed during PM. Major repairs or overhauls are performed on a timed-measured-frequency versus actual-condition basis. PM is a time-scheduled approach that includes routine lubrication, adjustments, and minor repairs.

Predictive Maintenance

The objective of predictive maintenance is to increase equipment reliability by identifying failure trends and initiating planned maintenance activities at an opportune time. This will minimize lost program time and high-maintenance costs associated with breakdown failures.

The LLNL predictive maintenance program uses the systematic observation of physical parameters, which are compared with known or predetermined limits, to assess equipment condition. Predictive maintenance uses techniques such as vibration analysis and oil analysis to predict when a piece of equipment will fail.

Maintenance Action and Frequency Selection

The objective of maintenance action and frequency selection is to improve equipment performance through enhancement of current PM tasks and frequencies. PM is enhanced by evaluating the basis for existing PM frequencies as well as available equipment maintenance and operational data.

PM tasks and frequencies have been based primarily on vendor recommendations and engineering judgment.

6. Maintenance Procedures

The facilities will develop maintenance procedures that specify the applicability and use of other work-related documents. The maintenance requirements may be documented in other procedures such as operating or calibration procedures as appropriate.

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Building 332 Maintenance Implementation Plan, Continued

6. Maintenance Procedures, Continued

This element is discussed in the following subsections:

- Procedures development and writing
- Procedure verification
- Procedure validation
- Procedure approval
- Procedure control, periodic review, and revision

Procedures Development and Writing

The objective of procedures development and writing is to develop procedures for all work that could result in a significant process transient, degraded facility reliability, or a personnel or equipment hazard. Procedures should also be written for individual preventive maintenance actions.

A standardized format for writing procedures has been developed.

Procedure Verification

The objective of procedure verification is to verify and review each procedure for proper format, content, and technical accuracy. Verification will be conducted by one or more reviewers who were not involved in writing the procedure and who have appropriate knowledge in the activity or process addressed by the procedure.

The accountability program will verify that the proposed procedure is operable and is technically accurate. This verification process will be formalized and documented in the original procedure by the accountable program and will be included in subsequent procedure revisions. Programmatic research equipment maintenance verification procedures do not need to be formalized or documented. The first line supervisor approves all procedures, which signifies that the procedure has been verified.

Procedure Validation

The objective of procedure validation is to validate each procedure to ensure that it is usable and correct and that it provides the proper guidance for performing the maintenance activity. Procedures will be validated by responsible line management prior to their use.

The first line supervisor is responsible for ensuring that all procedures are validated.

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Building 332 Maintenance Implementation Plan, Continued

Procedure Approval

All procedures for equipment operations and maintenance must be approved by the Facility Engineer, and must be reviewed by one appropriate line supervisor. The approval of the Facility Engineer assures that the information is complete and format is acceptable for use. All maintenance must be performed according to approved procedures located at the facility.

Procedure Control, Periodic Review, and Revision

Administrative controls must be established for the identification and issue of procedures. Procedures will be reviewed triennially for changes affecting content (reference material revisions, permanent changes, incorporation of industry experience, etc.). They will also be reviewed for philosophy, format enhancements, and human-factors considerations. Procedures will have the following controls:

- Distribution will be controlled and documented.
- An administrative document will be used to control temporary changes (temporary alterations allowing work to be safely continued) to procedures. If the changes need to remain in effect beyond their original effective dates, the temporary changes must undergo the same review and approval process as required for new procedures.
- An administrative document will be used to control procedure revisions (permanent alterations that incorporate outstanding, extensive changes, and other needed updates). Revisions will be reviewed and approved in the same manner as new procedures.

The Master Equipment List includes the procedure approval date and the scheduled date for review by the Facility Engineer. Each procedure will be reviewed every two years. Storage and retrieval of procedures will be provided at the facility. Before performing maintenance activities, the personnel performing maintenance on real property or any building safety systems (BSS) component will sign-in at the Building Coordinator's office and review the applicable procedure. Copies of the applicable procedures are on file in the facility to assure that the correct, approved procedure is used.

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Building 332 Maintenance Implementation Plan, Continued

Procedure Control, Periodic Review, and Revision, Continued

LLNL's general policy is to follow procedures as written; however, a written procedure may be unnecessarily restrictive. Therefore, the Facility Engineer may approve temporary changes that clearly do not change the intent of the procedure. The temporary changes must be documented in the procedure files. The Facility Engineer's approval of changes to procedures will ensure that the operational status of BSS and components are not degraded below the margin of safety. In the event of an emergency not covered by an approved procedure, knowledgeable facility personnel will take corrective action to minimize personnel injury and damage to the facility and to protect health and safety of the public.

7. Planning, Scheduling, and Coordination of Maintenance

This element is discussed under the following two subsections:

- Planning and scheduling for maintenance activities
- Procedure control, periodic review, and revision

Planning and Scheduling for Maintenance Activities

Maintenance will be performed according to a uniformly established single-priority system with emphasis on safety-related structures, systems, and components. We will provide methods for coordinating required radiation work permits (as described in FSPs) in the work-control process. The facility system will develop scheduling capability for maintenance activities. Control of outages will be inherent in the process, and coordination with other organizations will be addressed.

Plan of the Day schedules will be developed to identify and provide oversight capabilities for maintenance activities in the facility. All maintenance and construction activities involving the facility must be planned. The plan should allow at least two days time for appropriate review of the proposed work to assure the continued safety of the facility. The plan will consider the possible safety consequences of concurrent or sequential maintenance, testing, or operating activities. Maintenance plans and schedules developed must be approved by the Facility Engineer or designee prior to implementation. Program Maintenance/Construction Activity Sheets for all anticipated maintenance are presented to the Facility Engineer and, when completed, are filed in the Building Coordinator's office in Building 332.

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Building 332 Maintenance Implementation Plan, Continued

Procedure Control, Periodic Review, and Revision

The planning process will consider the following:

- Planning priorities
- Identification of required personnel resources
- Work instructions and procedures
- Required work permits
- Completed job documentation requirements

8. Control of Maintenance Activities

The control of maintenance activities will ensure that maintenance practices are effective in maintaining safe and reliable facility operations. Rigorous control of maintenance activities should be directed toward achieving high-quality work performance, personnel safety, equipment and system protection, and facility safety and reliability.

This element is discussed under the following subsections:

- Work control procedure
- Work request
- Supervision of maintenance activities
- Review of completed work request
- Temporary repairs
- Control of nonfacility personnel

Work Control Procedure

The objective of a work control procedure is to identify facility deficiencies and needed work. It will avoid redundant identification of these deficiencies and guide the accomplishment of work and subsequent post-maintenance activities through clear and concise procedures or instructions.

Work control is administered by functional areas of the facility staff. Work-control procedures and documentation have been established and are included in the FSP.

Work Request

The objective of work requests is to provide a work control document to initiate all facility maintenance activities. These documents will be used to clearly define the work to be performed, applicable prerequisite requirements, and data or information needed to perform the activities safely.

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Building 332 Maintenance Implementation Plan, Continued

Work Request, Continued

These documents will include information such as:

- Work procedures, instructions, and references
- Job priority
- Safety and radiation protection requirements
- Limiting conditions for operation
- Authorization and review signatures
- Equipment identification
- Post-maintenance testing requirements

The facility has established procedures (i.e., work request and work permit) to perform the activities within the authorization of the FSP.

Supervision of Maintenance Activities

Maintenance supervisors will monitor work in progress to ensure that maintenance activities are being conducted in accordance with DOE and facility-specific policies and procedures.

Deficiencies that are identified by operating personnel during regular daily operations, scheduled facility walk-throughs, or maintenance post-maintenance testing shall be reported promptly and corrective action taken. Guidance for the appropriate corrective action to be taken is provided in the BSS document. Deficiencies not corrected shall be tracked on DefTrack or the CAR system.

Review of Completed Work Request

Post-job reviews should be conducted to evaluate and critique the work performed and to provide feedback to planning, scheduling, and maintenance personnel.

Oversight of real property maintenance is controlled through access requirements and post-maintenance testing surveillance.

Temporary Repairs

All temporary repairs should be performed under the provisions of a facility temporary modification program. Components are replaced during day-to-day activities with temporary equipment as approved by the cognizant manager. When this occurs, a Temporary Status form will be filed in the Building Coordinator's office. Each month the Facility Engineer will review and update the current Temporary Status forms. Once the permanent equipment is installed and operation verified, the temporary status sheets will be discarded.

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Building 332 Maintenance Implementation Plan, Continued

Control of Nonfacility Personnel

Provision should be made to ensure that nonfacility contractors are trained and qualified for the maintenance work they are to perform.

Qualification, verification, and control of nonfacility contractors is currently under the direction of the facility training office and controlled by the facility access office.

9. Post-Maintenance Testing

A post-maintenance test program includes specifying, performing, documenting, and accepting the post-maintenance testing.

Limited post-maintenance testing (PMT) following maintenance in the facilities is currently performed on selected safety systems. Testing is done on a case-by-case basis. Formal documentation of post-maintenance test selection, performance, data, and evaluation requires improvement.

10. Procurement of Parts, Materials, and Services

Proper parts and materials in good condition are necessary to maintain design requirements for maintenance activities. An effective procurement process should be developed in conjunction with the quality assurance requirements of DOE Order 5700.6B, Quality Assurance.

Written procurement policies are being developed that will address obtaining parts, material, and services that meet established requirements and perform as expected. The policies will address the development and maintenance of the following procurement controls:

- Applicable technical and administrative requirements—such as specifications, codes, standards, tests, and inspections—will be invoked, and procurement documents will include acceptance criteria.
- Appropriate controls will be imposed for the selection, determination of suitability, evaluation, and receipt of all purchased items, including commercial-grade items to ensure that they perform as expected.
- Procured items and services will be accepted using specified methods such as review of manufacturing process control data, source verification, receipt inspection, preinstallation and post-installation test, certificates of conformance, or a combination of these methods.

Continued on next page

Building 332 Maintenance Implementation Plan, Continued

10. Procurement of Parts, Materials, and Services, Continued

- Before a procured item is used or placed in service, the procurement specification, inspection, and test requirements will be satisfied. Nonconformances will be properly dispositioned by means of a Disposition Report that addresses the process to qualify any nonqualified material, if so desired.
- Quality assurance records will be controlled and maintained to provide documentation for qualified parts and materials and to ensure tracability of parts and materials.

11. Material Receipt, Inspection, Handling, Storage, Retrieval and Issuance

The facility staff will review the need for on-hand spare parts at the organizational level and establish spare parts stock as required to support the operation. The facility staff will establish controls to ensure that the critical spare parts for high-importance PP&PE are properly identified, stored, and retrievable.

Procedures, controls, and guidance for storing and handling of materials is the responsibility of the requesting organization.

12. Control and Calibration of Measuring and Test Equipment

The control and calibration of measuring and test equipment (M&TE) should ensure the accurate performance of facility instrumentation and equipment for testing, calibration, and repairs.

Limited control of testing equipment following maintenance in the facilities is currently performed on selected safety systems. Formal documentation of test equipment is performed on all equipment identified on the M&TE list.

13. Maintenance Tools and Equipment Control

Maintenance tools and equipment control addresses the need for an effective program in order to accomplish maintenance activities effectively and efficiently.

The facility does not have a program for controlling tools.

14. Facility Condition Inspection

Management oversight of facility conditions shall be performed. General housekeeping and cleanliness inspections of operating areas are performed periodically. This element is discussed under the following subsections:

- Policy
- Training
- Reporting deficiency and deficiencies follow-up

Continued on next page

Building 332 Maintenance Implementation Plan, Continued

Policy	Our objective is to establish standards for routine facility condition and housekeeping inspections that meet both the mission of the facilities and the programs they support. Standardization of inspection requirements and frequencies will be coordinated with organizational maintenance requirements. These standards must be communicated effectively to all personnel. The Facility Manager and the facility staff are responsible for the safe conduct of all activities in the facility and provide management oversight in the facility for the Laboratory Director through the Associate Director for Defense Systems. Facility Management is defined in the Building 332 FSP.
Training	Our objective is to develop training for inspection personnel to ensure consistent application of inspection standards for both the facility inspection program and the routine facility condition and housekeeping program.
Reporting Deficiencies and Deficiency Follow-Up	Our objective is to report deficiencies and provide a system to track all identified deficiencies, concurrent action plans, and status of periodic reviews. Deficiencies that are identified by operating personnel during regular daily operations or scheduled facility walk-throughs shall be reported promptly and corrective action taken. Guidance for the appropriate corrective action to be taken is provided in the BSS document. Deficiencies not corrected shall be tracked on DefTrack of the CAR system.
15. Management Involvement	Management actively provides direction, training, and resources to ensure excellence in products. For facilities to operate efficiently, effectively, and safely, all levels of management must communicate their goals throughout their organizations. LLNL has a maintenance program review and assessment whose objective is to measure maintenance program effectiveness through inspections, audits, reviews, investigations, and self-assessments. Data collected should be used to improve existing programs. The facility has a monitoring program to ensure that administrative controls are maintained and reviewed monthly.

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Building 332 Maintenance Implementation Plan, Continued

16. Maintenance History

An effective maintenance history and trending program is necessary to establish the retrieval, analysis, and use of equipment, component, and system information to improve facility reliability and enhance the Facility Life Extension Program.

Our maintenance program does not track maintenance history. Support groups will maintain records and should determine trends in identified components as applicable to the graded approach category.

17. Analysis of Maintenance Problems

LLNL uses the following methods to analyze maintenance problems:

- **Information Collection—**Collect data on unplanned occurrences that affect safety or reliability and are of a recurring nature. Include in the collected information, the maintenance and operational history of the component, diagnostic information, training of personnel, and other information relating to the unplanned event.
- **Event Analysis—**Use the information collected for maintenance analysis to reconstruct the unplanned event. Identify apparent causal factors and categorize them into human- or equipment-performance problems.
- **Cause Determination—**Evaluate the actual or probable causes of a problem by one or more techniques or methodologies (i.e., event and causal factor charting, fault-tree analysis, change analysis, barrier analysis, etc.) to establish a final root cause.
- **Corrective Action—**Following determination of the root cause, develop, execute, and track to completion a corrective action plan (i.e., maintenance request for repair, changing frequency of preventive maintenance, counseling personnel, or modifying the training program).
- **Correction Action Followup—**Perform post-maintenance tests, retests, or close monitoring of the operation for a period of time following corrective action. Similarly, perform long-term followup when corrective actions such as retraining, procedural changes, and preventive maintenance changes are necessary.

18. Modification Work

Temporary repairs or modifications should be evaluated, documented, and controlled in a manner commensurate with the original requirements established for, and restrictions imposed on, the item being repaired or modified. Temporary repairs or modifications should receive a safety review prior to implementation to ensure the adequacy of the repair and to determine its effect on personnel safety and equipment reliability.

Continued on next page

Building 332 Maintenance Implementation Plan, Continued

19. Other Maintenance Considerations

The facility will review PP&PE that is located outside or otherwise exposed to the elements and devise seasonal procedures if there is a significant potential for damage caused by extreme weather conditions.

The facility has provided safety evaluations for seismic events, provided technical safety requirements for extreme wind conditions, and has the necessary heating devices to protect the facility from freezing conditions.

Appendix B.7

Separator Demonstration Facilities Complex Maintenance Implementation Plan

Facility Description

The Separator Demonstration Facilities (SDF) Complex includes three buildings: Buildings 490, 491, and 493. These facilities are used in support of continuing development and demonstration work for the Uranium Atomic Vapor Laser Isotope Separation (U-AVLIS) Program. These are all classified as Category 3 (low-hazard) nonreactor nuclear facilities and contain no safety-class systems as defined in Department of Energy (DOE) Order 6430.1A, General Design Criteria.

Building 490

Building 490 houses equipment for large-scale U-AVLIS separator demonstrations, technician office space, and other direct operational support space; it also contains a large mechanical equipment room for Building 490. Building 490 was originally constructed in 1985 as a two-story structure with a rigid steel frame and reinforced-concrete construction. It contains a basement, ground floor, second floor, and mezzanine levels. The building has generally been well-maintained and has no significant outstanding issues with building support systems. The major experimental areas in Building 490 underwent a significant modification during 1991 and 1992 to accommodate advanced-design separator components and to meet current building code requirements.

Current projects are in progress to consolidate and upgrade certain fire detection and suppression systems to support improved Laboratory operations and to address relatively minor deficiencies found as part of an ongoing self-assessment program. Major programmatic systems in Building 490 include vacuum vessels and related vacuum pumping systems, power conditioning systems, safety interlock systems, radiological control systems—including a high-efficiency particulate air- (HEPA-) filtered negative-air system, closed-loop cooling systems, waste retention and control systems, and control and data recording instrumentation equipment.

Building 491

Building 491 is used for post-run operational support to disassemble and refurbish separator hardware. Building 491 was originally constructed in 1985 and was upgraded during Fiscal Year 1992 to 1993 to accommodate advanced-design separator components and to meet current building code requirements. It is a two-story, steel-frame, metal-sided structure containing basement, ground floor, and mezzanine levels. The building has been well-maintained and has no significant outstanding issues with building support systems. An ongoing self-assessment program has been used to detect and correct any minor deficiencies. Major programmatic systems inlude negative-air hoods and enclosures, radiological control systems, including a HEPA-filtered negative-air system, and waste retention and control systems.

Continued on next page

Separator Demonstration Facilities Complex Maintenance Implementation Plan, Continued

Building 493

Building 493 is used for warehouse and storage of materials for separator operations, including uranium feedstock, subsystem assembly, and small-scale component testing. Building 493 was constructed in 1988 and has generally been well-maintained, with no significant outstanding issues with building support systems. It is a two-story, steel-frame, metal-sided structure with all activities at ground level. An ongoing self-assessment program has been used to detect and correct any minor deficiencies. A current project is in progress to upgrade the building to an Uniform Building Code H-7 zone classification, to provide additional utility services, and to meet current building code requirements where necessary. There are currently no larger-scale programmatic systems in Building 493.

Self-Assessment

This section summarizes our self-assessment of the current maintenance program for the SDF Complex. It reports the status of implementation for each major element contained in Chapter II of DOE Order 4330.4B, Maintenance Management Program.

The emphasis of this appendix is on personal property and programmatic equipment (PP&PE). Maintenance of real property and installed equipment (RP&IE) is assigned to the central maintenance organization at Lawrence Livermore National Laboratory (LLNL) and, therefore, the scope of the following discussion does not include RP&IE unless it is relevant and important to a specific performance objective. (See Appendix A for a discussion on RP&IE.)

Other institutional organizations are also often used to achieve certain specific performance objectives (Procurement, Receiving, Supply and Distribution, etc.). This is also noted where appropriate under each element or through other supporting documentation. Chapter II also states that other programs or processes that already encompass the material or processes of a given maintenance performance objective may be used to satisfy that portion of the maintenance performance objective. In the discussion below, other documents, programs, or processes are referenced that address a certain maintenance performance objective.

In the self-assessment that follows, we have included a discussion of the status and relevant near-term plans for implementing the objectives of the 17 elements in DOE Order 4330.4B, Maintenance Management Program.

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Separator Demonstration Facilities Complex Maintenance Implementation Plan, Continued

Responsibility for Maintenance

Within the SDF Complex, the maintenance of PP&PE is the responsibility of the U-AVLIS Program, which operates the facility. The type of equipment and the form of maintenance within the SDF Complex generally fall within two categories:

- Larger-scale demonstration equipment for which maintenance often is planned synchronously with major operational runs.
- Smaller laboratory-scale equipment, which is operated by a lead responsible individual and a small number of technicians who typically perform maintenance.

In most cases, the programmatic equipment within SDF is maintained by operational personnel, and the maintenance function is an integral part of operation of the facility. As a result, several elements of the DOE order are not directly applicable. Periodic inspection and maintenance of safety-related systems—such as electrical or laser safety interlocks, pressurized systems, etc.—are formalized and controlled in accordance with established Laboratory and programmatic requirements.

2. Maintenance Organization and Administration

Both the Laser Directorship and the U-AVLIS Program have established organizations and individuals that provide interfaces with the central maintenance organization for the maintenance of RP&IE.

Within the U-AVLIS Program, the maintenance of programmatic equipment is assigned by line management to responsible individuals, each of whom is responsible for the safe and reliable operation of a given activity area. LLNL has documents that describe the management organization within the U-AVLIS Program. Within the SDF Complex, Lead Experimenters are assigned to each of several major experimental areas. The operational status of these facilities are evaluated prior to each major experimental run, tested in prerun checks or testing, and typically reviewed by senior management. Maintenance work is typically scheduled synchronously with these runs or more frequently, if necessary, to assure safe and reliable operation.

We have established a preventive maintenance plan for the early operation of SDF. While major portions of the document are still applicable, certain specific processes—such as quality level assignments and the database—need to be revised to reflect the present operational methodology and to achieve a more cost-effective program.

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Separator Demonstration Facilities Complex Maintenance Implementation Plan, Continued

2. Maintenance Organization and Administration, Continued

Thus, a well-defined organizational and administrative structure exists to provide and control an appropriate level of equipment maintenance. A revision of the plan is necessary to incorporate programmatic changes and to reflect the current Laboratory maintenance program and equipment scope.

3. Training and Qualification of Maintenance Personnel

The training and qualification of personnel for all operations within the U-AVLIS Program, including maintenance, is discussed in a Facility Safety Procedure (FSP) and the LLNL *Health and Safety Manual.* In particular, a training and qualification program for personnel within the SDF Complex is established by the *SDF Personnel Training and Qualification Plan.* This program has been implemented.

4. Maintenance Facilities, Equipment, and Tools

Most programmatic equipment within SDF is maintained by operational personnel and the maintenance function is an integral part of operation of the facility. Thus, in general, no distinction of facilities, equipment, or tools required for maintenance is appropriate or necessary. In particular, items relating to the operation and maintenance of radiological control areas are controlled in accordance with established Laboratory and programmatic requirements.

For cases where identified portions of a programmatic system are maintained by the Laboratory's central maintenance organization, the responsibility for controlling maintenance equipment and tools belongs to that organization.

5. Types of Maintenance

The maintenance of programmatic equipment is an integral part of the operation of the equipment and the facility. Inspection and preventive maintenance occurs before each major experimental run or more frequently, if required. Lead operators are intimately familiar with the condition of the equipment so that a formal predictive maintenance program is not appropriate or cost effective. The failure of equipment between runs is typically not of significant impact to the program. Significant equipment failures during a major experimental run are identified in a post-run review, a cause is determined, and a corrective action identified.

A list of systems and equipment that require special attention for maintenance because of their environment, safety, and health (ES&H) or programmatic impact are identified for the SDF Complex. This list may need to be revised to meet the current requirements of the University of California Contract 48 and as established by subsequent Laboratory interpretations and standards.

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Separator Demonstration Facilities Complex Maintenance Implementation Plan, Continued

6. Maintenance Procedures

Requirements for work processes and procedures within the U-AVLIS Program, including those related to maintenance, are established . Within SDF, the operation and maintenance of major systems are the responsibility of the same individual or group and the equipment or system maintenance cycle is integrated with the major operational cycle of SDF. Thus, for nonsafety-related systems, maintenance procedures are integrated with operational procedures, use manufacturer procedures, or use procedures that are part of the basic skill, experience, or general training of the operator. Maintenance, inspection, or testing procedures for safety-related systems (electrical or laser safety interlocks, pressurized systems, etc.) are formally documented by the responsible individual, where the item is unique, or use procedures that are established by other organizations within the Laboratory.

7. Planning, Scheduling, and Coordination of Maintenance

Because the U-AVLIS Program contains several facilities that operate continuously (three shifts, seven days per week) or for long duration (up to one to two weeks), an important interface between the U-AVLIS Program and the Laboratory's central maintenance organization is the proper scheduling of utility outages for maintenance and modifications. A formalized monthly outage planning meeting is held to schedule outages; this serves to avoid costly unplanned outages and minimize downtime for experimental systems. A SDF representative is present to coordinate activities with that facility.

As described above, the use of a formal Work Control System is not appropriate or cost effective due to the integrated nature of SDF maintenance and operations. Planning, scheduling, and coordination of maintenance activities occur at operational planning meetings that involve lead personnel, supervisors, operational staff, and other affected persons or groups.

8. Control of Maintenance Activities

As discussed in Element 6, a formalized Work Control Program does not provide a cost-effect control of maintenance activities within SDF, due to the integrated nature of maintenance and operations. However, SDF maintenance activities are planned, documented, and controlled through:

- Planning and post-run meetings and reviews
- Prerun tests and inspections for major runs
- The use of laboratory logbooks and run documentation

Continued on next page

Separator Demonstration Facilities Complex Maintenance Implementation Plan, Continued

8. Control of Maintenance Activities, Continued	Senior management is involved in the planning, post-run, and technical analysis reviews of major experimental runs. As discussed previously, safety-related systems receive formalized control and documentation in accordance with Laboratory requirements.
9. Post-Maintenance Testing	Due to the integrated nature of maintenance and operations in SDF, a formalized Post-Maintenance Program is not appropriate or cost-effective. Within SDF, there is no equipment maintenance that directly affects the technical safety requirements (TSRs—called "Operational Safety Requirements"). Safety-related systems receive periodic and formal inspections or tests that constitute preventive maintenance and testing.
10. Procurement of Parts, Materials, and Services	Requirements for procurement of material within the U-AVLIS Program, including those related to maintenance, are established.
11. Material Receipt, Inspection, Handling, Storage, Retrieval, and Issuance	We have established requirements for the receipt, inspection, handling, storage, retrieval, and issuance of material within the U-AVLIS Program, including that related to maintenance of programmatic equipment.
12. Control and Calibration of Measuring and Test Equipment	Requirements for calibration of operational equipment within the U-AVLIS Program, including measuring and test equipment (M&TE), are established.
13. Maintenance Tools and Equipment Control	Because of the integrated nature of maintenance and operations within the SDF Complex, the control of tools or equipment for maintenance is part of the normal work process. Planning, scheduling, and coordination of operations and maintenance activities by supervisory and operational staff, as discussed above, assures the availability of required equipment. Special tools are often required for operational and maintenance activities. The design of any such equipment that potentially involves ES&H or significant programmatic impact requires review, as established both by Laboratory requirements and by the U-AVLIS Program.

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Separator Demonstration Facilities Complex Maintenance Implementation Plan, Continued

14. Facility Condition Inspection

A formal program of periodic ES&H inspections of facilities and programmatic equipment exists within the U-AVLIS Program, in accordance with requirements established by the Laboratory and the L&EP Directorate. Lack of good housekeeping measures, which may impact the safe operation of a facility, are noted in the self-assessment. The results and status of these self-assessments are reviewed by senior line management. This program includes the facilities within the SDF Complex.

15. Management Involvement

As discussed in connection with previous maintenance elements, line management of the U-AVLIS Program is directly involved with the planning, operation, technical results, and ES&H inspections of major facilities, including the SDF Complex. The review and tracking mechanisms permit communication and the use of lessons learned by both program management and the operational staff.

16. Maintenance History

As discussed previously (in Elements 6 and 7), the integrated nature of operations and maintenance does not make the use of a formal maintenance history and trending program. The operational and maintenance history of major systems, such as those in SDF, is summarized and formally documented as part of planning, execution, and analysis of major experimental runs. Operational or maintenance information of other subsystems, smaller facilities, or components that may be useful for future deployment activities is maintained in operational logbooks or other technical records or reports.

Trending or other analysis of operational data, which may include maintenance or reliability information, is used when a system is sufficiently mature to make the data meaningful or when there is a value to such analysis.

17. Analysis of Maintenance Problems

Systematic analysis should be used to determine and correct root causes of unplanned occurrences related to maintenance. The activities associated with this element—including information collection, failure or root-cause analysis, failure or incident reporting, inspection reports, incident analysis, and corrective action and follow-up—are discussed as part of other elements above (see Elements 7, 13, and 15).

18. Modification Work

Controls regarding the design and modification process of both RP&IE (institutional property) and PP&PE (programmatic equipment) are established. Working interfaces are established through operational and coordination meetings, such as those discussed in Element 6.

Appendix B.8

Hazardous Waste Management Facilities Maintenance Implementation Plan

Summary

This appendix to Lawrence Livermore National Laboratory's (LLNL) Maintenance Implementation Plan (MIP) provides the information requested by Department of Energy (DOE) Order 4330.4B, Maintenance Management Program, concerning the Hazardous Waste Management (HWM) Division's maintenance program. In addition to a description of the facilities governed by HWM's maintenance program, it discusses, in order, the 17 elements of the MIP as they relate to HWM.

In many instances, HWM's Maintenance Program depends on maintenance interface with support organizations at the Laboratory upon whose maintenance practices and procedures HWM relies to implement its maintenance functions. These support organizations are: Plant Engineering, Mechanical Engineering, Hazards Control, and the Fire Department. When appropriate, the maintenance work done for HWM by these support organizations is cited and their practices and procedures referenced in discussing the elements of the MIP requested in DOE Order 4330.4B, Maintenance Management Program.

Facility Description

HWM facilities consist of various buildings and structures for waste management and storage. The structures of concern for this MIP are:

- Area 514 Facility (Buildings 513, 513A, 514, and 514A)
- Area 612 Facility (Buildings 612, 612A, 614, and 625 and Trailers 6197, 6197B, and 6198)
- Building 693
- Building 233, Waste Storage Area

All of these facilities are rated as Category 3 nuclear facilities. HWM uses them to treat, process, store, and ship hazardous, radioactive, and mixed wastes generated at the Laboratory off-site to approved disposal sites.

Area 514 Facility

The Area 514 Facility is made up of four buildings and a treatment tank farm used primarily to store and process low-level aqueous waste. The separate units in the Area 514 Facility are as follows:

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Hazardous Waste Management Facilities Maintenance Implementation Plan, Continued

Area 514 Facility, Continued

- Building 513
  - Solidification Unit
  - Shredding Unit
  - Container Storage Unit
- Building 514—Silver Recovery Unit
- Area 514
  - Wastewater Filtration Unit
  - Wastewater Treatment Tank Farm Unit
  - Storage Tank 5145–R501 Unity
- Area 514-1 Container Storage Unit
- Area 514-2 Container Storage Unit
- Area 514-3 Container Storage Unit

Area 612 Facility

The Area 612 Facility is made up of four buildings, three tents, and various storage areas. The complex is primarily used to receive, stage, store, repackage, and ship hazardous and radioactive waste. The separate units in the Area 612 Facility are as follows:

- Area 612 Portable Tank Storage Unit
- Area 612 Tank Trailer Storage Unit
- Area 612-1 Container Storage Unit
- Area 612-2 Container Storage Unit
- Area 612-4 Receiving, Segregation, and Storage Unity
- Area 612-5 Container Storage Unit
- Building 612
  - Drum/Container Crushing Unit
  - Size Reduction Unit
  - Lab Packing/Packaging Container Storage Unit
  - Container Storage Unit

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Hazardous Waste Management Facilities Maintenance Implementation Plan, Continued

Area 612 Facility, Continued

- Building 614
  - West Cells Container Storage Unit
  - East Cells Container Storage Unit
- Building 625
  - East Container Storage Unit
  - West Container Storage Unit

Other Facilities

Building 693 is a single building used for storing hazardous waste before off-site shipment, but it contains no radioactive waste. Therefore, it is not listed as a nuclear facility.

The Building 233 Waste Storage Area is a covered storage area over which HWM has jurisdiction. It is attached to Building 233 over which HWM does not have jurisdiction. The storage area is used for the storage of classified and radioactive waste, including transuranic waste.

For the most part, HWM stages waste already packaged by the generators until the proper disposal method and location are determined. Some treatment, however, takes place at the Area 612 Facility (e.g., shredding and size reduction) as well as repacking (laboratory packing) for economy of packaging and compatibility.

The Building 514 Wastewater Treatment Tank Farm and Filtration Units are the major processing units for which HWM is responsible. Low-level radioactive aqueous wastes and some hazardous liquid wastes are treated there on a batch basis with flocculating reagents before being vacuum filtered to remove hazardous and mixed-waste constituents as solids. The solids are stored and eventually disposed of as waste; the filtered wastewater is, after testing, sent to sewer.

Other treatment operations undertaken at the Area 514 Facility include silver recovery and solidification of aqueous mixed waste.

Self-Assessment of Maintenance Program

In general, HWM's Self-Assessment of its maintenance program is provided in Elements 2 through 18 below. As appropriate to the element, we have cited the Support Services Group's *Operations Manual* as the source of the group's procedures governing the maintenance considered by that element or made reference to the procedures of the group, division, or department that cooperates with HWM's Support Services Group in handling that maintenance element.

Continued on next page

Hazardous Waste Management Facilities Maintenance Implementation Plan, Continued

Self-Assessment of Maintenance Program, Continued

To date, the maintenance program provided by HWM's Support Services Group is the product of a long evolution consistent with the general operating and maintenance procedures of the Laboratory and the various state and federal agencies that have jurisdiction over it. It has also been a cooperative effort with other organizations at the site, particularly the Fire Department, Hazards Control, Plant Engineering, Mechanical Engineering, and the Laboratory's Motor Pool.

2. Maintenance Organization and Administration

The HWM Support Services Group is part of the Facilities and Assessments Section of HWM. The Support Services Group has primary responsibility for the maintenance of HWM facilities and equipment. It operates under the guidelines set forth in the Support Services Group *Operations Manual,* which was prepared in compliance with the HWM *Management Plan.* The master copy of this *Operations Manual* is kept by the Support Services Group Supervisor; a shop copy is housed in the maintenance shop at Building 514.

3. Training and Qualification of Maintenance Personnel

The training requirements of the HWM Support Services Group are kept on file in the Environmental Protection Department's Training Office as are the training records of each group member. Both are available though the HWM Support Services Group Supervisor.

4. Maintenance Facilities, Equipment, and Tools

In the Area 514 Facility, the HWM Support Services Group maintains a maintenance shop and the equipment and tools required for inspection and repair of equipment used by HWM. HWM Support Services Group personnel are responsible for maintaining the shop, equipment, tools, parts, and materials in proper and good working order. Torque wrenches and scales used by HWM personnel are tracked by the Support Services Group Supervisor.

Other Laboratory organizations that support HWM's Maintenance Program maintain their own shops, equipment, and tools required to perform their support functions.

5. Types of Maintenance

The Support Services Group *Operations Manual* lists the types of maintenance provided by the Support Services Group to HWM.

The Fire Department is responsible for the inspection, testing, and maintenance of the fire suppression systems throughout HWM facilities. Equipment consists of sprinkler systems, hydrants, and portable extinguishers.

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Hazardous Waste Management Facilities Maintenance Implementation Plan, Continued

5. Types of Maintenance, Continued

Hazards Control is responsible for the inspection, testing, and maintenance of the radiological monitoring equipment used within HWM facilities and for the inspection and testing of high-efficiency particulate air (HEPA) filters.

Plant Engineering is responsible for the inspection, testing, and maintenance of:

- Air-handling equipment, including hood blowers and heating, ventilating, and air-conditioning units
- Alarms
- Cranes
- Evacuation systems
- Roll-up doors

The Mechanical Engineering Department supervises the inspection and calibration of certain quality-affecting measuring and test equipment.

The Laboratory's Motor Pool maintains and repairs HWM's vehicles and fork trucks.

6. Maintenance Procedures

The Support Services Group *Operations Manual* lists the maintenance procedures used by the Support Services Group to HWM.

The Fire Department provides its maintenance activities to HWM according to the following procedures:

- No. 1410 for Testing and Maintenance of Automatic Sprinkler Systems
- No. 1412 for Hydrant Flow Testing and Inspection
- No. 1507 for Fire Extinguisher Testing

Hazards Control inspects, tests, and maintains radiological monitoring equipment used within HWM facilities according to their Radiation Safety Instrumentation Calibration and Test Procedures. They inspect and test HEPA filters using American National Standards Institute Standard N510.

Plant Engineering maintains the records and performs inspection, testing, and maintenance of air-handling equipment, alarms, cranes, evacuation systems, and roll-up doors according to their relevant procedures.

The Laboratory's Motor Pool maintains and repairs HWM's vehicles and fork trucks according to their established maintenance procedures.

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Hazardous Waste Management Facilities Maintenance Implementation Plan, Continued

7. Planning, Scheduling, and Coordination of Maintenance

Planning, scheduling, and coordination of maintenance activities performed by HWM Support Services Group are described in the *Operations Manual.* All requests for work are submitted to the Support Services Supervisor by means of a Support Services Request (SSR) form. The form must be filled out as completely as possible except in case of emergency or for tasks that can be completed within 10 minutes or less. In emergencies, the SSR is completed after the fact to document the work effort.

See Element 6 above for the relevant Fire Department, Hazards Control, Plant Engineering, and Motor Pool procedures governing planning, scheduling, and coordination of maintenance activities provided by them to HWM.

8. Control of Maintenance Activities

The control of maintenance activities is covered by a Support Services Request form or a Preventive Maintenance Inspection form.

See Element 6 above for the relevant Fire Department, Hazards Control, Plant Engineering, and Motor Pool procedures governing control of maintenance activities provided by them to HWM.

9. Post-Maintenance Testing

Post-maintenance testing is covered by a Support Services Request form or a Preventive Maintenance Inspection form, samples of which are available from the Support Services Group Supervisor and in the group's *Operations Manual.*

See Element 6 above for the relevant Fire Department, Hazards Control, Plant Engineering, and Motor Pool procedures governing post-maintenance testing provided by them to HWM.

10. Procurement of Parts, Materials, and Services

The HWM Support Services Group conducts all outside procurements of part, materials, and services according to the HWM Management Plan governing Acquisition and Installations (MP100). Basically, this procedure requires that all requests for outside procurements be submitted to the Support Services Group Procurement Coordinator by means of an HWM Purchase Request form, which is processed according to the procurement procedures and regulations of the LLNL Procurement Department.

Requests for supplies that may be obtained through Laboratory Stores are submitted to the HWM Supply Clerk, who places, tracks, receives, and distributes all supplies to the requester.

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Hazardous Waste Management Facilities Maintenance Implementation Plan, Continued

11. Material Receipt, Inspection, Handling, Storage, Retrieval, and Issuance	Procedures governing material receipt, inspection, handling, and storage for the Support Services Group of HWM are provided in the group's *Operations Manual*. Procedures concerning receipt, inspection, handling, and storage of maintenance materials procured by the LLNL Procurement Department at HWM's request or by another department or division operating at HWM's request and on its behalf are governed by that entity's procedures as noted elsewhere in this document (Elements 6 and 10 in particular).
12. Control and Calibration of Measuring and Test Equipment	All tools and equipment that are determined "quality affecting" are tested and calibrated annually. Within HWM, three basic types of tools or equipment are quality affecting: torque wrenches, scales, and radiation detectors. Logs of the scales and torque wrenches used in quality-affecting operations are maintained by the HWM Support Services Supervisor. The Torque Wrenches Inspection (Calibration) Log and the Platform Scale Inspection (Calibration) Log have unique identifiers for each piece of equipment and note the last date each was calibrated and the due date for the next calibration. The torque wrenches and scales are inspected by an outside certified repair and testing company. The radiation detection equipment is maintained and tracked by Hazards Control through their Safety Technician assigned to HWM.
13. Maintenance Tools and Equipment Control	Maintenance tools and equipment control for the HWM Support Services Group is outlined by the its *Operations Manual.* See Element 6 above for the relevant Fire Department, Hazards Control, Plant Engineering, and Motor Pool procedures governing maintenance tools and equipment control for services provided by them to HWM.
14. Facility Condition Inspection	Facility condition inspections for HWM facilities under the jurisdiction of the HWM Support Services Group is handled by the Facilities Management Group of the Facilities and Assessments Section of HWM with the maintenance support provided as needed by the Support Services Group, which is also a part of the Facilities and Assessments Section of HWM.

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Hazardous Waste Management Facilities Maintenance Implementation Plan, Continued

14. Facility Condition Inspection, Continued

Daily, weekly, and daily when-in-use inspections of operating units of HWM are undertaken by the Operations Section of HWM. Reports of deficiencies and problems over which the Support Services Group has jurisdiction are handled by the SSR form discussed in Element 7 above.

See Element 6 above for the relevant Fire Department, Hazards Control, and Plant Engineering procedures governing facility condition inspection of relevant HWM facilities or parts thereof over which they have maintenance jurisdiction.

15. Management Involvement

The overall organization of HWM provides management involvement in the Support Services Group's maintenance activities and responsibilities from top to bottom. As outlined above in Element 2, the Support Services Group reports within the Facilities and Assessments Section where it receives maintenance, inspection, and assessment support from groups with concerns similar to its own. It also has clear communication with the management of other sections within the division (Waste Operations and Technology and Information Systems) which rely on the Support Services Group for basic facilities maintenance and for access to the specialized maintenance services required by all HWM sections.

16. Maintenance History

Maintenance history of HWM facilities and equipment is undertaken by the Support Services Group Supervisor in accordance with the directives of the Group's *Operations Manual.*

See Element 6 above for the relevant Fire Department, Hazards Control, Plant Engineering, and Motor Pool procedures governing maintenance history of HWM facilities and equipment over which they have maintenance jurisdiction.

17. Analysis of Maintenance Problems

Analysis of maintenance problems is undertaken by the Support Services Group Supervisor in conjunction with HWM management and all other HWM groups and sections as appropriate and necessary and in accordance with the directives of the Support Services Group's *Operation Manual*.

See Element 6 above for the relevant Fire Department, Hazards Control, Plant Engineering, and Motor Pool procedures governing analysis of maintenance problems for maintenance services provided by them to HWM.

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Hazardous Waste Management Facilities Maintenance Implementation Plan, Continued

18. Modification Work

Modification work is covered by a Support Services Request form according to directives in the group's *Operations Manual*.

See Element 6 above for the relevant Fire Department, Hazards Control, and Plant Engineering procedures governing modification work provided by them to HWM.

Appendix B.9
Building 334 Maintenance Implementation Plan

Facility Description

Building 334, Hardened Engineering Test Building, is located in the Superblock (330 block) of Lawrence Livermore National Laboratory (LLNL). It is operated by the Weaponization Program for the Defense and Nuclear Technologies Directorate. The building is a three-story, windowless, concrete, test cell consisting of two high bays, two control rooms, an equipment room, and two restrooms.

Facility Purpose

Building 334 is intended for the testing of weapons and weapons components. The Radiation Measurements Facility provides static measurements of Intrinsic Radiation generated by test units.

The Engineering Test Bay is used for thermal and dynamic tests which approximate the Stockpile-to-Target Sequence of the weapon system.

Facility Operations

All employees shall work in accordance with the requirements of the:

- Safety Analysis Report (SAR)
- Facility Safety Procedure (FSP)
- Applicable Operations Safety Procedures (OSP)
- LLNL *Health and Safety Manual*
- LLNL *Environmental Protection Handbook*

Supervisors are responsible for assuring that safety procedures are followed. Employees are to take reasonable precautions to protect themselves and fellow employees and to perform only those tasks that can be safely accomplished.

Facility Status

Building 334 is a test cell used for conducting both passive and active tests of the engineering design of weapon components. As such, the building does not maintain a continuing inventory of special nuclear material (SNM). During periods of nonuse, the building has no material that warrants a nonreactor nuclear facility categorization. During these periods, the facility is maintained as any other LLNL facility.

2. Maintenance Organization and Administration

The Facility Manager has maintenance oversight responsibilities. Because the facility is devoid of SNM most of the time, maintenance is scheduled during these windows. As such, the maintenance organizations supply personnel qualified to support any nonnuclear facility at LLNL.

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Building 334 Maintenance Implementation Plan, Continued

3. Training and Qualification of Maintenance Personnel	Plant Engineering, Hazards Control, Materials Management, Electronics Engineering, and Mechanical Engineering will continue their current training and qualification programs to ensure that the skills and knowledge required of maintenance personnel are developed and maintained.
4. Maintenance Facilities, Equipment, and Tools	Support organizations provide their own tools. Special tools or training are not required; equipment is standard throughout the Laboratory.
5. Types of Maintenance	Programmatic equipment inspection and maintenance, if required, occurs before each engineering test. Operators are trained to do maintenance on all programmatic equipment. Facility support systems are maintained as needed during nontest windows.
6. Maintenance Procedures	Each of the maintenance support organizations provide written procedures for the maintenance of equipment under their stewardship.
7. Planning, Scheduling, and Coordination of Maintenance	Each of the maintenance support organizations plan and schedule preventive maintenance according to their procedures. Both preventive maintenance and corrective maintenance are coordinated through the Facility Manager or representative.
8. Control of Maintenance Activities	Maintenance activities are controlled by the informal windowing of maintenance. Maintenance will only be performed when there is no SNM in the facility. Maintenance personnel are required to contact facility management before doing any work in the building.
9. Post-Maintenance Testing	Post-maintenance testing is not a requirement of facility management. However, it may be required by the maintenance support organization.
10. Procurement of Parts, Materials, and Services	Each of the maintenance support organizations are responsible, to the Facility Manager, for the procurement of parts, materials, and services required to maintain the equipment under their stewardship.

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Building 334 Maintenance Implementation Plan, Continued

11. Material Receipt, Inspection, Handling, Storage, Retrieval, and Issuance	There is no requirement for on-hand spare parts. This element is handled by the support organizations.
12. Control and Calibration of Measuring and Test Equipment	The maintenance support organizations are responsible for the control and calibration of Measuring and Test Equipment that they require in accordance with the new LLNL Calibration Program for Measuring and Test Equipment (Draft).
13. Maintenance Tools and Equipment Control	Support organizations are responsible for their own tools and equipment.
14. Facility Condition Inspection	The Facility Manager is responsible for the safe conduct of all activities in the facility. The Defense and Nuclear Technologies Directorate *Environmental, Safety, and Health Self Assessment Plan* provides guidance and defines lines of authority.
15. Management Involvement	Facility management is involved in all maintenance activities in the building because access requires passage through both the CAIN system and vault doors, and only facility management can provide that access.
16. Maintenance History	Maintenance histories are kept by the support organization.
17. Analysis of Maintenance Problems	Analysis of maintenance problems are conducted by the support organizations. Facility management is to be informed about all root-cause conclusions before corrective action.
18. Modification Work	Permanent and temporary modification work performed in the facility will be approved by the Facility Manager. If the work exceeds that defined in the FSP, then an OSP is required. If the safety envelop is violated, a safety evaluation is needed.

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Building 334 Maintenance Implementation Plan, Continued

Modifications to the Implementation Schedule

Due to Building 332's effort to prepare and submit a facility Safety Analysis Report (SAR) in accordance with DOE Order 5480.23, Safety Analysis Report, the milestone to categorize maintenance items using a graded approach (Task 2.1) was missed. The revised implementation schedule is provided below.

Task	Description	Completion Date
2.1	Apply graded approach to identified Category 1, 2, and 3 systems	March 10, 1995

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